ACQUISITION COORDINATE COMPUTATION FOR TRACKING AND SURVEILLANCE SENSORS PROGRAM DOCUMENT

TECHNICAL DOCUMENTARY REPORT NO. ESD-TDR-65-160

December 1964

R. G. Schinnerer
D. R. Thompson

496L SYSTEM PROGRAM OFFICE
ELECTRONIC SYSTEMS DIVISION
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE
L. G. Hanscom Field, Bedford, Massachusetts

Prepared under Contract No. AF 19(628)-3438 by Aeronutronic,
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FOREWORD

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ABSTRACT

A computer program has been developed to calculate acquisition coordinates of earth satellites for three types of sensors: planar fan, horizontal fan and tracker. The program is equipped to consider the special requirements of phased array trackers, such as the AN/FPS-85. Included in the document are the program description, formulation, operating instructions, flow diagrams, and test cases.

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SECTION 1

INTRODUCTION

The Observing Schedule Program (OBSERV) is programmed for the Philco 2000 computer and is to be part of tne B-3 Semi-Automatic Program System (SPS) at the SPADATS Center in Colorado Springs, Colorado. It functions in conjunction with the Executive Program and receives its input from the Schedule, SEAI and FAN input tapes.

OBSERV has been developed to compute sets of acquisition coordinates for stations with fixed beam surveillance devices and sensors that can track satellites. The capability to handle phased array trackers of the AN/FPS-85 type has also been included. For surveillance devices, the program computes the time and coordinates of beam penetration by all satellites requested on the input tape. For tracking devices, the program calculates acquisition coordinates at evenly spaced intervals of time, as specified by the input, during the periods that a satellite is within the tracker coverage.

The primary mode of operation for one specified sensor is the computation of acquisition coordinates of specified satellites in the current satellite population. The results are then presented for each station in chronological order. Data listed for each time point include the identification and the acquisition coordinates of the satellite currently being observed. Satellite positions are computed using the simplified general perturbations technique used in other SPS programs (Hilton, 1963). Flexibility in the program is provided by various input and output control options. The program has been designed for maximum computational efficiency. This will result in a significant reduction in the computer time required for each case.

In addition to the features mentioned above, the program may also be used to simulate sensor-satellite patterns.

SECTION 2

PROGRAM DESCRIPTION

The program OBSERV is designed to calculate acquisition coordinates for sensors of three primary types: planar fan, horizontal fan and tracker. The overall program functions are shown schematically in Figure 1 and are described in the following subsections.

2.1 INITIALIZATION

The initialization consists of two basic parts: (1) initialization for each sensor and (2) initialization for each satellite being processed for the given sensor.

a. Initialization by Sensor

In this section the time limits for acquisition coordinate computation are established, the topocentric coordinate system for this station is computed from the azimuth and elevation angle of the boresight vector (if required), and the sidereal time at the station is computed at the "beginning reference time."

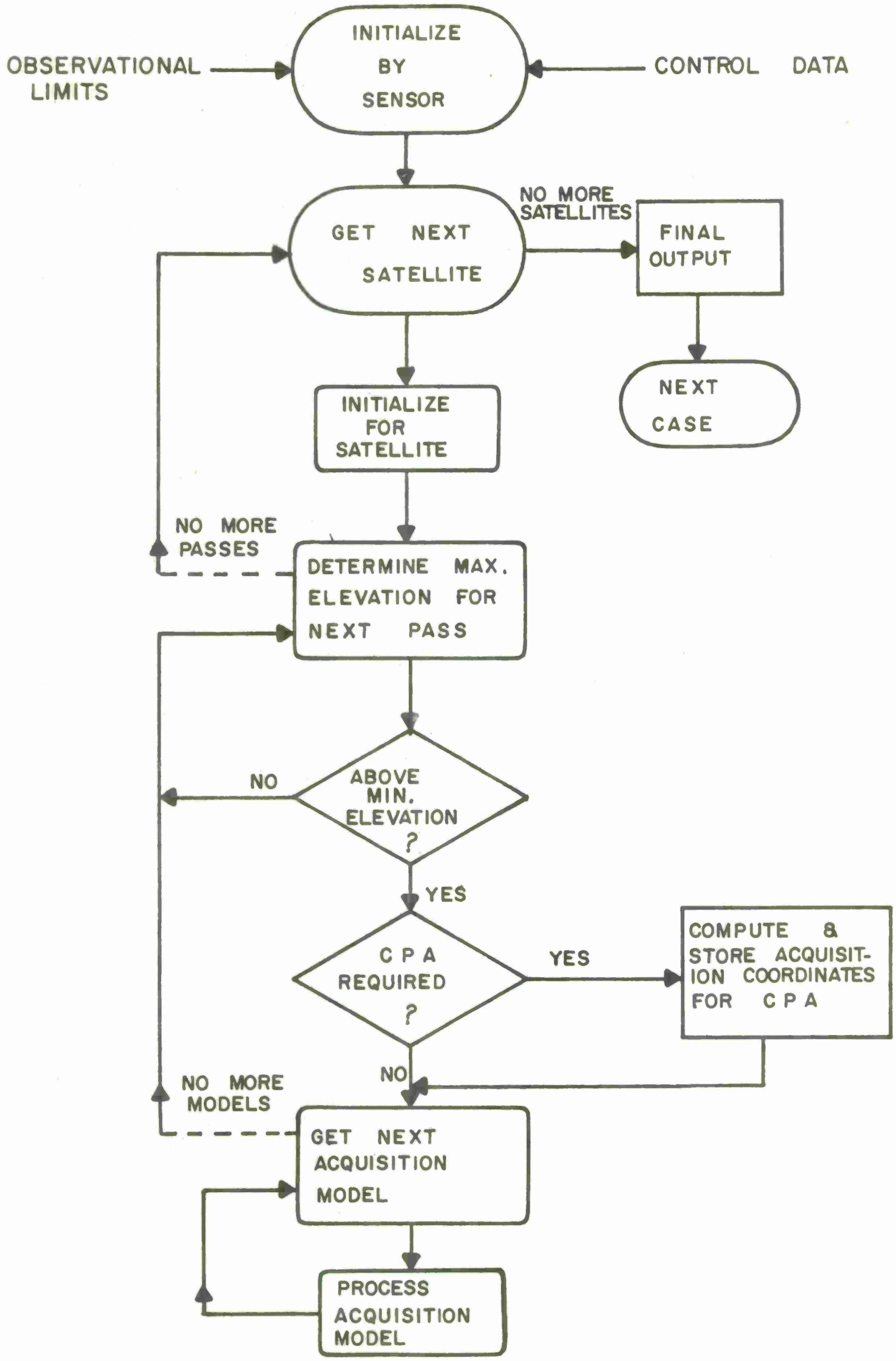


FIGURE I OBSERV PROGRAM FUNCTIONS

The time limits and the azimuth and elevation angles of the boresight vector are obtained from the input control card.

b. Initialization by Satellite

The orbital elements for each satellite are obtained from the system subroutine NXTELM. Using these, the calculations shown in Section 3.2 are performed. The minimum elevation angle, h_{min}, is obtained from either the fan card or the tracker card depending on the radar type being processed.

2.2 PRELIMINARY ACQUISITION COMPUTATIONS

This section is entered once for each revolution of the satellite falling within the requested time limits. The formulation given in Section 3.3 is used to obtain the time at which the satellite is at a maximum elevation angle with respect to the sensor. If the point of maximum elevation is below the horizon of the sensor, the calculations are performed again for the next revolution, unless the upper time limit has been passed. If the point of maximum elevation is above the sensor's horizon, a return is made to the main program to test the point against the minimum observable elevation angle. If it is above, the calculation continues to obtain the acquisition points required; if not, a return is made to the beginning of the subroutine to try again on the next revolution.

If acquisition coordinates for the closest point of approach (CPA) are requested, they are computed at the time of maximum elevation.

2.3 ACQUISITION MODELS

The term "Acquisition Model" denotes a mathematical scheme which describes the manner in which a sensor effects satellite acquisition. Four such acquisition models are contained in this program (see Figure 2). They are: (1) the subroutine PACQUI, designed for planar fan radars; (2) the subroutine HACQUI, used for horizontal fan radars; (3) the subroutine TACQUI, a generalized tracker acquisition model; and (4) the subroutine TACQUI1, a specialized subroutine used by TACQUI to obtain acquisition times for phased array trackers. Each acquisition model is successively processed for one pass before the next pass is considered.

Each case may contain as many as thirty acquisition models for one station; however, only one tracker model may be used. The acquisition types need not be ordered.

a. Subroutine PACQUI

This subroutine uses iteration by halving to calculate the topocentric coordinates of the satellite at the time of fan penetration. It then checks to ensure that the satellite is within the observational limits of the fan. If it is, the acquisition coordinates are stored for output.

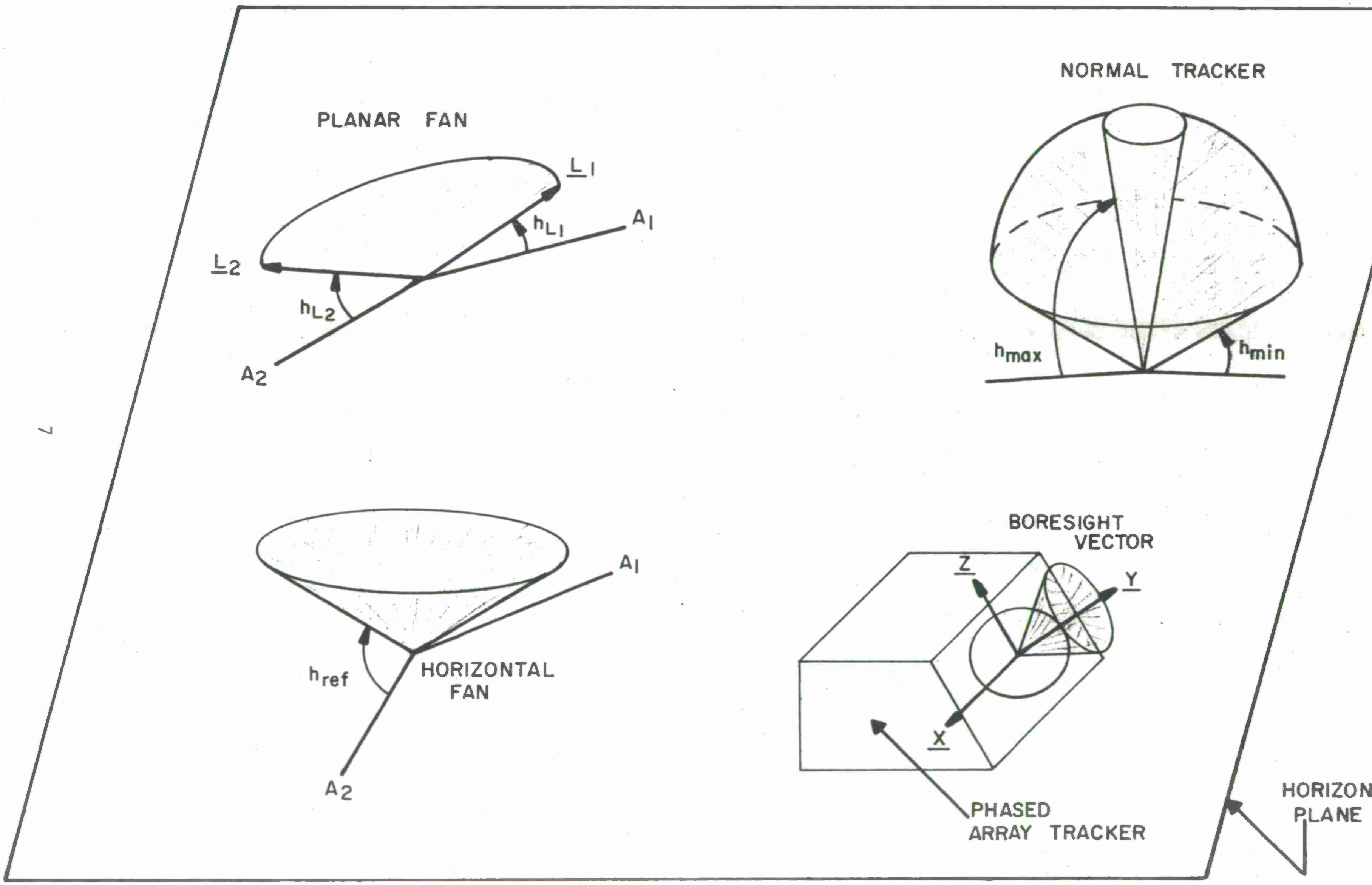


FIGURE 2 RADAR COVERAGE ASSUMED BY THIS PROGRAM

b. <u>Subroutine HACQUI</u>

The horizontal fan acquisition model calculates the points at which the satellite penetrates a cone which forms a constant angle with the horizon. If the points are within the azimuthal and range limits of the fan, they are stored for output. The maximum observable range is assumed to vary linearly between the angular limits of the fan.

c. <u>Subroutine TACQUI</u>

This subroutine makes use of either HACQUI or TACQUI1 (as required) to obtain the time span during which the satellite is observable by the tracker. It then computes the acquisition coordinates specified by the input tracker card: either a specified number of points per pass (ranging from two to eight), or a specified time interval between points.

Tracking limits for a normal tracker are determined by a vertical cone whose side forms an angle with the horizon equal to the minimum elevation angle. If the elevation angle of any point for a normal tracker is greater than the maximum, the point is rejected. No azimuth limits are assumed.

The tracking limits of a phased array tracker are determined by the minimum elevation angle, the limiting values of the direction cosines relative to the reference vectors normal to the boresight, and the maximum off-boresight angle.

d. <u>Subroutine TACQUI1</u>

This subroutine is used by subroutine TACQUI for phased array trackers. It uses iteration by halving to determine the acquisition coordinates and the times when the satellite enters and exits the coverage limits of the radar. Acceptable entry and exit points are stored for output.

2.4 FINAL OUTPUT

After every requested satellite has been processed through the acquisition models for one station, the accepted acquisition points are sorted either by time or by order of satellite appearance and output as shown in Figure 10.

The available output options are:

(1) The fan number may be output.

(2) The units of range and range-rate may be obtained in either nautical or MKS units.

(3) The direction cosines with respect to the topocentric reference system mav he obtained.

(4) The point of maximum elevation may be computed as an acquisition point.

(5) The output points may be restricted to the ascending half of each pass.

SECTION 3

FORMULATION

The acquisition coordinate computation program employs a simplified General Perturbations theory to calculate positions and velocities of the satellite. The formulation for this theory is given in the reference: Hilton, 1963. The remaining program formulation is detailed in the following subsections.

3.1 INITIALIZATION FOR EACH SENSOR

The following calculations are performed once for each station requiring acquisition coordinates:

(1) Compute the topocentric reference triad from the boresight azimuth and elevation:

$$\underline{x} \begin{cases} x_{xh} = \sin A_B \\ x_{yh} = \cos A_B \\ x_{zh} = 0 \end{cases} \tag{1}$$

$$\underline{y}\ \begin{cases} y_{xh} = -\cos h_B \cos A_B \\ y_{yh} = \cos h_B \sin A_B \\ y_{zh} = \sin h_B \end{cases} \tag{2}$$

$$\underline{z}\ \begin{cases} z_{xh} = \sin h_B \cos A_B \\ z_{yh} = -\sin h_B \sin A_B \\ z_{zh} = \cos h_B \end{cases} \tag{3}$$

(2) Compute the sidereal time at the station at the "beginning reference time"

$$\theta_i = (\dot{\theta} - 360)\ D + \dot{\theta} F + \theta_{gr_o} + \lambda_E \tag{4}$$

where D and F are, respectively, the days and fraction of a day of the "beginning time" into the reference year; θ_{gr_o} is the Greenwich sidereal time at the start of the year, λ_E is the east longitude of the observing station and $\dot{\theta}$ is the rotation rate of the earth.

3.2 INITIALIZATION FOR EACH SATELLITE

The following calculations are performed once for each satellite.

(1) Enter the XYZI subroutine to compute the time independent initial parameters required for the ephemeris subroutine, XYZSB.

(2) Calculate the epoch Greenwich sidereal time, θ_o:

$$\theta_o = \theta_i + \dot{\theta}\ (t_o - t_B) \tag{5}$$

where θ_i is from equation (4) and $(t_o - t_B)$ is the difference between the epoch time, t_o, and the input "beginning time" t_B.

(3) Compute sin and cos :

$$\sin \quad = \sin \left\{ (\dot{\Omega} - \dot{\theta}) \; \Delta t_1 \right\} \tag{6}$$

$$\cos \quad = \cos \left\{ (\dot{\Omega} - \dot{\theta}) \; \Delta t_1 \right\} \tag{7}$$

$$\text{where } \dot{\Omega} = -\frac{3}{2} J_2 \frac{a_e^2}{p^2} n \cos i \tag{8}$$

is the rotation rate of the earth and

Δt_1 is 5 minutes

(4) Compute K_1 the critical value for $\underline{Z} \cdot \underline{W}$, above which visibility of this satellite is not possible for this station (see Figure 3).

$$K_1 = q_2^{-1} \cos h_{min} \left\{ (q_2^2 - \cos^2 h_{min})^{1/2} - \sin h_{min} \right\} \tag{9}$$

where q_2, the geocentric apogee distance, is given by:

$$q_2 = a(1 + e) \tag{10}$$

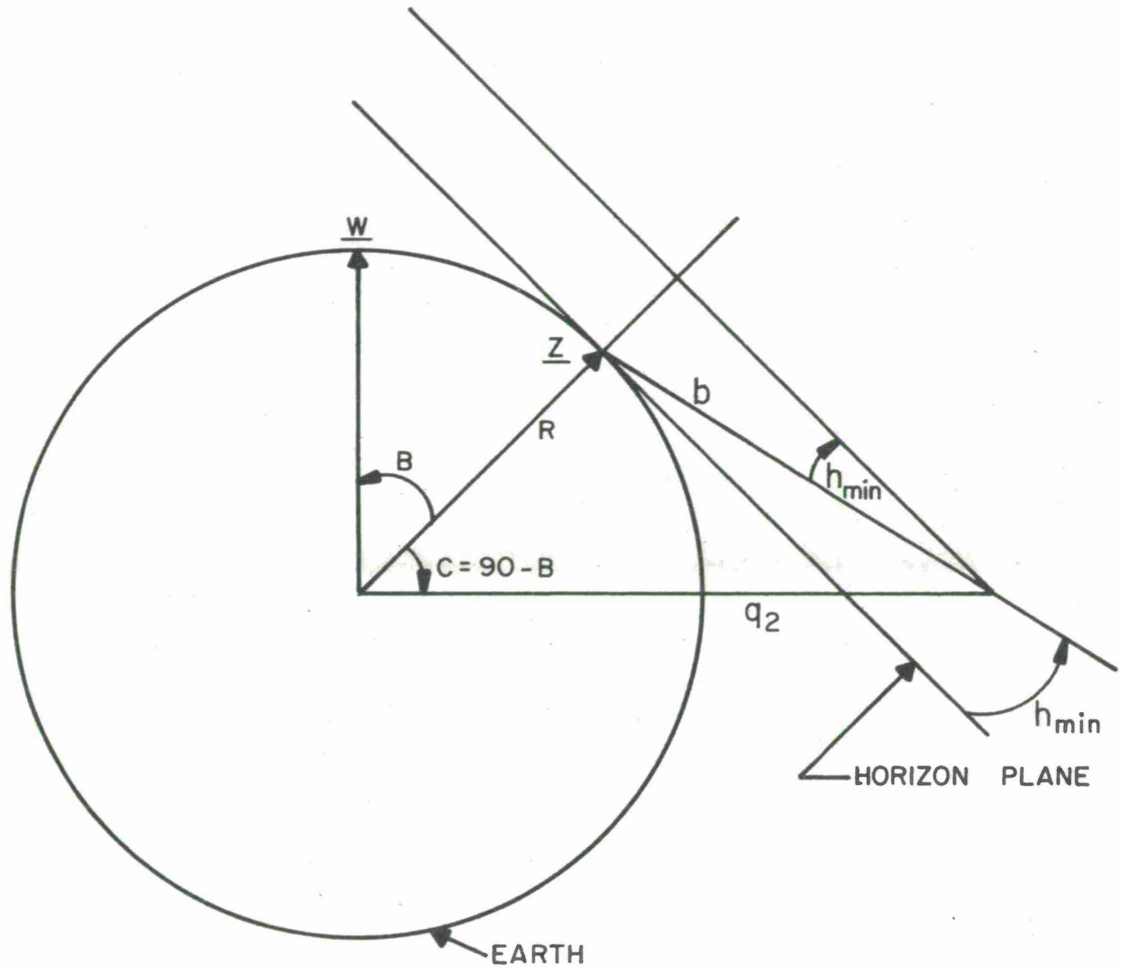
(5) Compute the revolution number at the "beginning time":

$$N_B = N_o + I \left\{ \frac{n_o}{2\pi} \cdot (t_B - t_o) \right\} \tag{11}$$

where N_o is the epoch revolution number and $I\{\ \}$ represents the integral part of the bracketed quantity

(6) The quantity t_L , used in later calculations, is set equal to zero at this point.

(7) The quantity ϵ, also used in later calculations, is set equal to 1/2 of the beamwidth of the sensor.



$\underline{Z} \cdot \underline{W} = \sin C$

$q_2 \sin C = b \cos h_{min}$

$q_2 \cos C = R + b \sin h_{min}$

ELIMINATING b TO SOLVE FOR sin C FROM THESE TWO EQUATIONS GIVES THE CRITICAL VALUE OF $\underline{Z} \cdot \underline{W}$ GIVEN BY EQUATION(9). THE ASSUMPTION IS MADE THAT THE EARTH IS SPHERICAL AND THEREFORE THAT R = 1.

$\underline{Z}$ IS A UNIT VECTOR DIRECTED TOWARD THE OBSERVERS ZENITH

$\underline{W}$ IS A UNIT VECTOR IN THE DIRECTION OF ORBITAL ANGULAR MOMENTUM

FIGURE 3 DERIVATION OF CRITICAL VALUE FOR $\underline{Z} \cdot \underline{W}$

3.3 COMPUTATION OF t AND $L_{zh_{max}}$ FOR EACH PASS

This calculation is used to determine the point of maximum elevation angle of the satellite with respect to the sensor.

(1) Set t_i equal to t_L and initialize for $\underline{Z} \cdot \underline{W}$ computation as follows:

$$\theta_t = \theta_o + \dot{\theta}(t_i + t_B - t_o) \tag{12}$$

$$\Omega = \Omega_o + \dot{\Omega}(t_i + t_B - t_o) \tag{13}$$

Compute the sine and cosine of $\Omega - \theta_t$

(2) Iterate on $\underline{Z} \cdot \underline{W}$ as follows: if $t_i + t_B > t_F$ return to main program; otherwise,

$$t_{i+1} = t_i + \Delta t_1 \tag{14}$$

$$\sin(\Omega - \theta_t)_{i+1} = \sin(\Omega - \theta_t)_i \cos\Delta + \cos(\Omega - \theta_t)_i \sin\Delta \tag{15}$$

$$\cos(\Omega - \theta_t)_{i+1} = \cos(\Omega - \theta_t)_i \cos\Delta - \sin(\Omega - \theta_t)_i \sin\Delta \tag{16}$$

$$\underline{Z} \cdot \underline{W}_{i+1} = \sin(\Omega - \theta_t)_{i+1} \cos\phi \sin i + \sin\phi \cos i \tag{17}$$

where t_F is the final time for which look angles are required and ϕ is the station latitude.

if $|\underline{Z} \cdot \underline{W}_{i+1}| \geq K_1$ continue the iteration; otherwise,

(3) Set t_i equal to $t_{i+1} - \Delta t_1$ and iterate on $\dot{L}_{zh}$ as follows:

(a) Enter the XYZSB subroutine to obtain the position and velocity of the satellite at time $t_i + t_B$

(b) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(4) Compute $\dot{\rho}_{zh}$, the zenithal component of the range velocity and $\dot{L}_{zh}$, the zenithal components of $\underline{\dot{L}}$.

$$\dot{\rho}_{zh} = (\dot{x} + \dot{\theta} y) \cos \phi \cos \theta + (\dot{y} - \dot{\theta} x) \cos \phi \sin \theta + \dot{z} \sin \phi \quad (18)$$

$$\dot{L}_{zh} = \frac{1}{\rho} (\dot{\rho}_{zh} - \frac{\dot{\rho}}{\rho} \rho_{zh})$$

$$\text{where } \theta = \theta_o + \dot{\theta} (t_i + t_B - t_o) \quad (19)$$

if $\dot{L}_{zh} \leq 0$ add Δt_2 to t_i (Δt_2 = 25 min. at present) and continue the iteration; otherwise, enter the following iteration on $\dot{L}_{zh}$:

add Δt_2 to t_i

(5) Enter the XYZSB subroutine to obtain the position and velocity of the satellite at time $t_i + t_B$

(6) Compute $\dot{L}_{zh}$ as above

if $\dot{L}_{zh} > 0$ continue the iteration; otherwise, set

Δt_{i-1} = 25 minutes and N = 0 and enter the following iteration on $\dot{L}_{zh}$:

(7) Iterate to obtain the point of maximum elevation:

$$\text{set } \Delta t_i = -\frac{1}{2} | \Delta t_{i-1} | \quad (20)$$

$$t_{i+1} = t_i + \Delta t_i \quad (21)$$

$$N = N + 1 \quad (22)$$

Enter the XYZSB subroutine and compute $\dot{L}_{zh}$ as above.

If N is less than 7 test $\dot{L}_{zh}$: 0; if $>$ set Δt_{i+1} =

$\frac{1}{2} | \Delta t_i |$ and continue iteration; if $\leq$ set

$\Delta t_{i+1} = -\frac{1}{2} | \Delta t_i |$ and continue iteration.

(8) If N = 7 compute $\ddot{L}_{zh}$ as follows:

$$\ddot{L}_{zh} = (\dot{L}_{zh_i} - \dot{L}_{zh_{i-1}}) / \Delta t \tag{23}$$

(9) Test the quantity $\frac{\dot{L}_{zh}}{\ddot{L}_{zh}}$: if

$$\left| \frac{\dot{L}_{zh}}{\ddot{L}_{zh}} \right| < \left| \frac{\Delta t}{2} \right| \text{ set } t_{i+1} = t_i - \frac{\dot{L}_{zh}}{\ddot{L}_{zh}} \text{ ; otherwise, set} \tag{24}$$

$$t_{i+1} = t_i + \frac{\dot{L}_{zh}}{|\dot{L}_{zh}|} \left| \frac{\Delta t_i}{2} \right| \text{ ; then compute } \underline{\rho}_h \text{ and } \dot{\rho} \tag{25}$$

as follows:

$$\theta = \theta_o + \dot{\theta} (t_{i+1} + t_B - t_o) \tag{26}$$

$$X = (X/\cos\theta) \cos\theta \tag{27}$$

$$Y = (X/\cos\theta) \sin\theta \tag{28}$$

where $X/\cos\theta$ is a station coordinate function obtained as input.

$$\underline{\rho}_h \begin{cases} \rho_{xh} = (x + X) \sin\phi \cos\theta + (y + Y) \sin\phi \sin\theta - (z + Z) \cos\phi \\ \rho_{yh} = -(x + X) \sin\theta + (y + Y) \cos\theta \\ \rho_{zh} = (x + X) \cos\phi \cos\theta + (y + Y) \cos\phi \sin\theta + (z + Z) \sin\phi \end{cases} \tag{29}$$

$$\rho = (\rho_{xh}^2 + \rho_{yh}^2 + \rho_{zh}^2)^{1/2} \tag{30}$$

$$\dot{\rho} = \frac{1}{\rho} \left\{ (x + X) (\dot{x} + y\dot{\theta}) + (y + Y) (\dot{y} - x\theta) + (z + Z)\dot{z} \right\} \tag{31}$$

$$\text{Set } t_L = t_{i+1} + \Delta t_1 + \Delta t_2 \tag{32}$$

(10) Test ρ_{zh}: if $\rho_{zh} > 0$, exit to next computation; otherwise return to the beginning of this section 3.3.(1) with the new t_L. If $\rho_{zh} \leq c(\sin h_{min} - \epsilon)$, also return to the beginning of this section with the new t_L.

3.4 COMPUTATION OF THE MAXIMUM ELEVATION

If the point of maximum elevation (CPA) is required, compute A and h as follows:

$$A = \tan^{-1} \frac{\rho_{yh}}{-\rho_{xh}} ; \quad 0 \leq A < 2\pi \tag{33}$$

$$h = \sin^{-1} \frac{\rho_{zh}}{\rho} \tag{34}$$

where ρ and $\underline{\rho}_h$ are available from the previous section at the time of closest approach.

3.5 DETERMINATION OF THE REQUIRED ACQUISITION MODEL

Test the radar type to determine which acquisition model is required:

Planar fans use PACQUI formulation.

Horizontal fans use HACQUI formulation.

Trackers use TACQUI formulation.

3.6 PACQUI FORMULATION

Acquisition model for planar fans

(1) Compute $\underline{\rho} \cdot \underline{N}$, where $\underline{N}$ is a unit vector normal to and above the plane of the fan.

$$\rho_{N_1} = \underline{\rho} \cdot \underline{N} \tag{35}$$

Set Δt = -10 minutes and $t_2 = t_i$

(2) Start iteration to make $\underline{\rho} \cdot \underline{N}$ change sign:

(a) If $\rho_{zh} \geq 0$ continue the iteration with (c); otherwise,

(b) If this is the first time through, set $t_i = t_2$ and exit, if this is not the first time through, set $\underline{\rho} \cdot \underline{N}$ equal to ρ_{N_1}, $\Delta t = +10$ and $t_i = t_2$; then go to step (d) to obtain the descending observation time.

(c) If $|\underline{\rho} \cdot \underline{N}| \leq \rho\epsilon$ go to the next subsection; otherwise,

(d) $$t_{i+1} = t_i + \Delta t \tag{36}$$

$$\rho_{N_3} = \underline{\rho} \cdot \underline{N} \tag{37}$$

(e) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(f) Compute $\underline{\rho} \cdot \underline{N}$ and test $\rho_{N_1} (\underline{\rho} \cdot \underline{N})$; if ≥ 0 continue the iteration with (a) above; otherwise, go to the next subsection.

(3) Iterate, by halving, to determine the time when the satellite passes within the observational limits of the fan.

(a) $$\Delta t_{i+1} = \frac{\rho_{N_3} (\underline{\rho} \cdot \underline{N})}{|\rho_{N_3} (\underline{\rho} \cdot \underline{N})|} \frac{\Delta t_i}{2} \tag{38}$$

(b) $$t_{i+1} = t_i + \Delta t_{i+1} \tag{39}$$

$$\rho_{N_3} = (\underline{\rho} \cdot \underline{N}) \tag{40}$$

(c) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31). (41)

(d) Compute $\underline{\rho} \cdot \underline{N}$ and test: if $|\underline{\rho} \cdot \underline{N}| \leq \rho\epsilon$ go to the next subsection; otherwise return to (a) above to continue the iteration.

(4) Test the observation with respect to the angular limits of the fan: if $(\underline{L} \cdot \underline{L}_1)\ (\underline{L} \cdot \underline{L}_2) \geq (\underline{L} \cdot \underline{L}_2)$, the observation is within the angular limits of the fan; otherwise, return to 3.6(2)(a). (42)

$\underline{L} = \frac{\underline{\rho}}{\rho}$; $\underline{L}_1$ and $\underline{L}_2$ are unit topocentric vectors defining the angular limits of the fan. (43)

(5) If range limits are specified perform the following test: if $\rho \leq \rho_{max1} + \rho'_{max} \cos^{-1} (\underline{L} \cdot \underline{L}_1)$ the range is observable. (44)

ρ_{max1} is the maximum observable range along $\underline{L}_1$

ρ'_{max} is the derivative of maximum observable range with respect to the angle $\cos^{-1} (\underline{L} \cdot \underline{L}_1)$. It is assumed linear for this program and is given by:

$$\rho'_{max} = \frac{\rho_{max2} - \rho_{max1}}{\cos^{-1} (\underline{L}_1 \cdot \underline{L}_2)} \tag{45}$$

(6) If the satellite is observable and the time of observation falls within the requested time limits, then perform the following calculations if illumination information is required.

(a) Compute the sun's true longitude, $\ell_\odot$, at time

$$\frac{(t_B + t_i)}{1440} = T: \tag{46}$$

$$\ell_\odot = L_\odot + n_\odot T + 1.91 \sin (n_\odot T - M_{\odot_o}) \tag{47}$$

where $n_\odot$ is the mean notion of the sun in degrees per day

$L_\odot$ is the mean longitude of the sun at time T, given by

$L_\odot = L_{\odot_o} + n_\odot T$; $L_{\odot_o}$ is the mean longitude of the sun at the beginning of the epoch year. (48)

$$M_{\odot} = L_{\odot_0} + n_{\odot} T - \pi_{\odot}; \ \pi_{\odot} \text{ is the sun's longitude of perifocus} \tag{49}$$

(b) Calculate the geocentric unit vector toward the sun, $\underline{L}_{\odot}$:

$$\underline{L}_{\odot} \begin{cases} L_{x_{\odot}} = \cos \delta_{\odot} \cos\alpha_{\odot} \\ L_{y_{\odot}} = \cos \delta_{\odot} \sin\alpha_{\odot} \\ L_{z_{\odot}} = \sin \delta_{\odot} \end{cases} \tag{50}$$

where $\alpha_{\odot} = \ell_{\odot} - 2.47 \sin 2 \ell_{\odot}$ (51)

$$\delta_{\odot} = \tan^{-1} (0.4336635 \sin\alpha_{\odot}) \tag{52}$$

(c) Calculate and test the elevation angle of the sun, $h_{\odot}$

$$h_{\odot} = \sin^{-1} (-\underline{L}_{\odot} \cdot \frac{\underline{R}}{R}) \tag{53}$$

where $\frac{\underline{R}}{R}$ is a unit vector from the station to the geocenter.

If $h_{\odot} > -5^{o}$, no visual points may be calculated.

If $h_{\odot} < -5^{o}$ the calculation continues to determine if the satellite is illuminated.

(d) It has already been established that the satellite is above the sensor's horizon. The Earth's shadow is assumed cylindrical. See Figure 4.

$$\cos \psi = \frac{1}{r} (\underline{L}_{\odot} \cdot \underline{r}) \tag{54}$$

(e) If $\cos \psi$ is positive, the satellite is illuminated. If $\cos \psi$ is negative, the satellite may still be illuminated. This is determined from γ and η as follows.

$$\gamma = \psi - 90^{o} \tag{55}$$

$$\eta = \sin^{-1} (\frac{R}{r}) \tag{56}$$

If $\gamma + \eta > 90^{o}$, the satellite is not visible, if $\gamma + \eta \leq 90^{o}$, the satellite is illuminated.

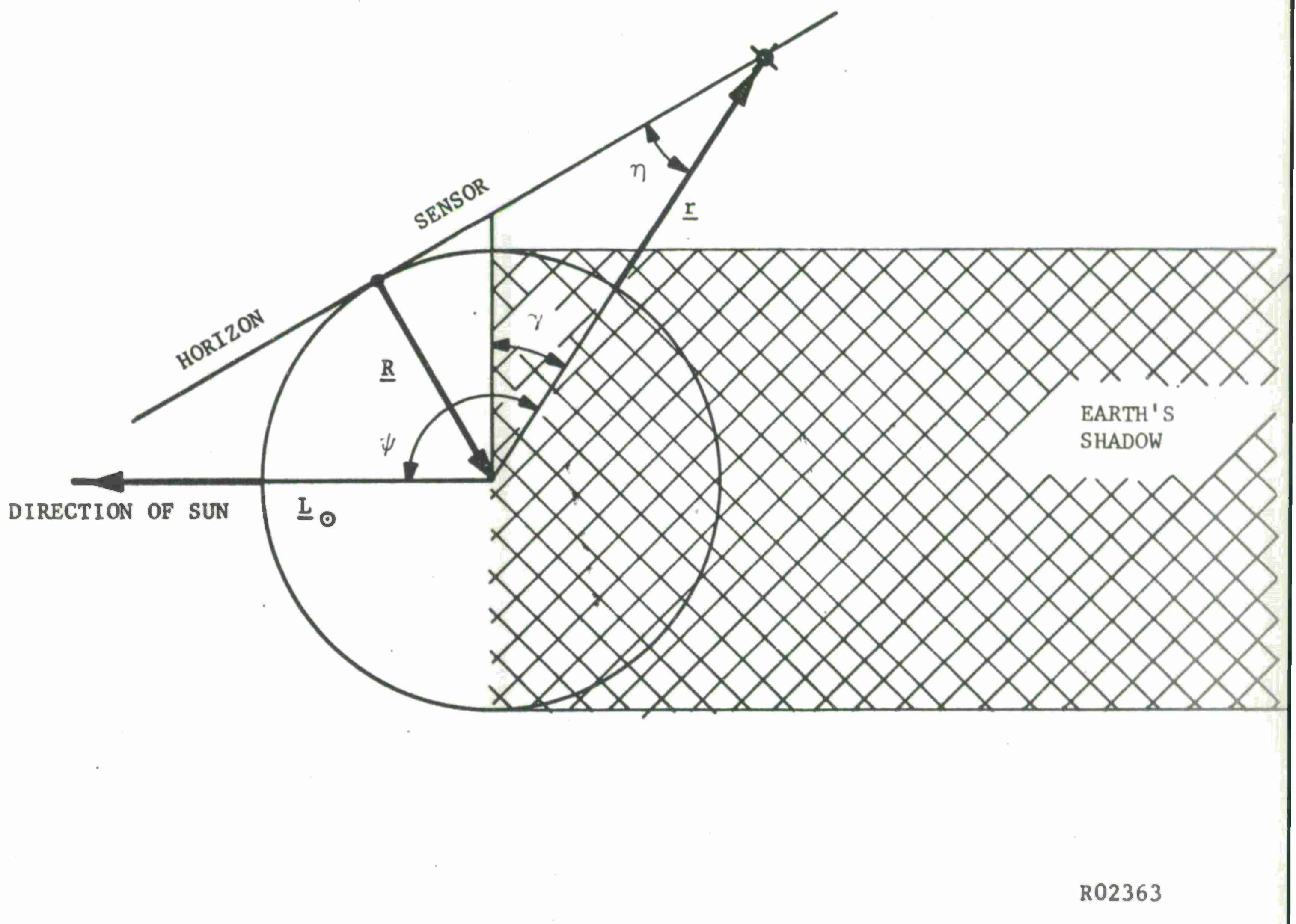


FIGURE 4. POSITION OF SATELLITE WITH RESPECT TO THE EARTH'S SHADOW

(7) If either the satellite is not observable or this is the first time through, and $t_i < t_2$; then set

$$\underline{\rho} \cdot \underline{N} = \rho_{N_1} \tag{57}$$

$$t_i = t_2 \tag{58}$$

$$\Delta t = 10 \text{ min} \tag{59}$$

and return to 3.6(3)(b). Otherwise, continue with the next subsection after storing the acquisition coordinates for output.

3.7 HACQUI FORMULATION

Acquisition model for horizontal fans

(1) Set $t_2 = t_i$ and $\Delta t = -10$ min.

(2) Iterate to make ρ_{zh} approach $\rho \sin h_{ref}$. $\cos h_{ref}$ and $\sin h_{ref}$ are available from the acquisition buffer (input quantities)

(a) If $\left| \rho_{zh} - \rho \sin h_{ref} \right| \leq \rho \, \epsilon \cos h_{ref}$ go to (60)

(4) below; otherwise, continue with (b)

(b) Set $K_3 = 1$ and $t_{i+1} = t_i + \Delta t$ (61)

(c) Compute ρ, $\dot{\rho}$ and ρ_h from equations (29) through (31).

(d) If $\rho_{zh} > \rho \sin h_{ref}$ return to (a) above; otherwise, continue with (3). (62)

(3) Iterate to obtain the time of fan penetration

(a)

$$\Delta t_{i+1} = \frac{K_3 \left(\rho_{zh} - \rho \sin h_{ref} \right)}{\left| K_3 \left(\rho_{zh} - \rho \sin h_{ref} \right) \right|} \cdot \frac{\Delta t_i}{2} \tag{63}$$

(b)

$$K_3 = \rho_{zh} - \rho \sin h_{ref} \tag{64}$$

$$t_{i+1} = t_i + \Delta t_{i+1} \tag{65}$$

(c) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(d) If $|\rho_{zh} - \rho \sin h_{ref}| > \rho \epsilon \cos h_{ref}$ return to (a); otherwise, continue with (4). (66)

(4) Compute A and h from ρ and $\underline{\rho}_h$:

$$A = \tan^{-1} \frac{\rho_{yh}}{-\rho_{xh}} \tag{67}$$

$$h = \sin^{-1} \frac{\rho_{zh}}{\rho} \tag{68}$$

(5) If this is a tracker to to (8); otherwise, continue with (6).

(6) If $(A_2 - A_1)(A - A_1)(A_2 - A) \geq 0$ the observation is within the angular limits of the fan so continue with (7). A_1 and A_2 are the azimuthal limits of the fan.

If < 0 and $t_i < t_2$, set $T_1 = t_i$, Δt = 10 min and $t_i = t_2$, then return to 3.7(2)(b); otherwise exit.

(7) If $\rho \leq \rho_{max1} + \rho'_{max}(A - A_1)$ the range is observable so continue with (8).

ρ_{max1} is the maximum observable range in the A_1 direction

ρ'_{max} is the derivative of maximum range with respect to $(A - A_1)$. It is assumed linear and is given by:

$$\rho'_{max} = \frac{\rho_{max2} - \rho_{max1}}{A_2 - A_1} \tag{69}$$

If $\rho > \rho_{max1} + \rho'_{max}(A - A_1)$ and $t_i < t_2$, set $T_1 = t_i$, Δt = 10 min and $t_i = t_2$, the return to 3.7(2)(b); otherwise exit.

(8) If the satellite is observable and the time of observation is within the requested time limits; then, if required, test for solar illumination using equations (46) through (56). If this is the first time through and $t_i < t_2$, set $T_1 = t_i$, Δt = 10 min and $t_i = t_2$, then return to 3.7(2)(b); otherwise, set $T_2 = t_i$ and $t_i = t_2$ and exit to the next subsection. In either case, store the acquisition coordinates for output.

3.8 TACQUI FORMULATION

Acquisition model for trackers

(1) If a maximum range is specified test ρ, if $\rho > \rho_{max}$ exit, otherwise continue with (2).

(2) If this is a phased array tracker, go to TACQUI1 (3.9). Otherwise, set $A_1 = 0$, $A_2 = 2\pi$ and go to HACQUI (3.7).

(3) If only the ascending half of the pass is required, set $T_2 = t_2$.

(4) Test the points per pass integer, P:

If P = 9, an output interval, Δt, is specified, so go to (5); otherwise set

$$\Delta t = \frac{T_2 - T_1}{P - 1} \tag{70}$$

$$t_i = T_1 \tag{71}$$

and go to (6).

(5) Set N = integral part of $(T_2 - T_1)/2\Delta t$ and (72)

$$t_i = \frac{1}{2}(T_2 + T_1) - (N + 1)\Delta t \tag{73}$$

(6) If this is a phased array, go to (8).

(7) If ascending points only are required, set

$$T_2 = T_2 + \Delta t \tag{74}$$

(8) Compute ρ, A, h and $\dot{\rho}$, for output, at each time point between T_1 and T_2 required by (4) or (5) above.

3.9 TACQUI1 FORMULATION

Acquisition model for phased array trackers

(1) Set $K_1 = 1$ and go to AFILT3 (3.10)

(a) if this observation passes the tests in AFILT3 or is marginal and visible, go to (4).

(b) if this observation fails the tests in AFILT3 or is marginal but not visible as described by equations 98-100, go to (2).

(2) Set $K_1 = -1$, $t_2 = t_i$, $K_3 = -1$ and $\Delta t = -0.2$ min (75)

(3) Iterate to check for visible points on this pass

(a) Set $t_{i+1} = t_i + \Delta t$ (76)

(b) Compute ρ, $\dot{\rho}$ and ρ_h from equations (29) through (31).

(c) If $\rho_{zh} > 0$ go to (d); if ≤ 0 and $t_i < t_2$, set

$t_i = t_2$, $\Delta t = 0.2$ and $K_1 = +1$ and go to (a). (77)

(d) Go to AFILT3

If the satellite fails the tests in AFILT3, return to (a).
If it passes the tests, set $t_2 = t_i$ and go to (e).
If it is marginal, set $t_2 = t_i$ and go to (8).

(e) Set $\Delta t_{i+1} = \frac{1}{2} K_3 \; \Delta t_i$ and go to (7). (78)

(4) Set $t_2 = t_i$, $K_3 = +1$ and $\Delta t = -10$ min (79)

(5) Set $t_{i+1} = t_i + \Delta t$. (80)

Compute ρ, $\dot{\rho}$ and ρ_h from equations (29) through (31).
Go to AFILT3

If the satellite passes the tests in AFILT3, return to the beginning of 3.9(5).
If it fails the tests, go to 3.9(6).
If it is marginal, go to 3.9(8).

(6) Set $\Delta t_{i+1} = -\frac{1}{2} K_3 \Delta t_i$ and $K_3 = -1$ (81)

(7) Iterate to obtain the times of marginal visibility

(a) Set $t_{i+1} = t_i + \Delta t_{i+1}$

(b) Compute ρ, $\dot{\rho}$ and $\underline{\rho}_h$ from equations (29) through (31).

(c) Go to AFILT3

If the satellite passes the tests in AFILT3 go to 3.9(3)(e).
If it fails the tests go to 3.9(6).
If it is marginal go to 3.9(8).

(8) Compute A and h from equations (67) and (68) and:

If this is the first time through set

$$T_1 = t_i \tag{83}$$

$$t_i = t_2 \tag{84}$$

$$\Delta t = 10K_1 \tag{85}$$

$$K_3 = 1 \tag{86}$$

and go to 3.9(5); otherwise, if $t_i > T_1$ set $T_2 = t_i$; if $< T_1$ set (87)

$$T_2 = T_1 \tag{88}$$

$$T_1 = t_i \tag{89}$$

and exit.

3.10 AFILT3 FORMULATION

Determine whether the satellite is visible, invisible or marginally visible to the sensor at this time.

(1) Test against minimum elevation angle

(a) Set $\delta = \rho_{zh} - \rho \sin h_{min}$ and (90)

$$E = \rho \epsilon \cos h_{min} \tag{91}$$

U_{max}, V_{max}, $\cos \psi_{max}$, $\sin h_{min}$, and $\cos h_{min}$ are stored from input into the FANTAB buffer.

(b) Go to AFILT31 (3.11)

(2) Test against maximum off boresight angle

(a) Set $\delta = \underline{\rho} \cdot \underline{y} - \rho \cos \psi_{max}$ (92)

$E = \rho \epsilon \sin \psi_{max}$ (93)

(b) Go to AFILT31

(3) Test against minimum angle from $\underline{z}$ axis

(a) Set $\delta = \rho U_{max} - |\underline{\rho} \cdot \underline{z}|$ (94)

$E = \rho \epsilon (1 - U^2_{max})^{1/2}$ (95)

(b) Go to AFILT31

(4) Test against minimum angle from $\underline{x}$ axis

(a) Set $\delta = \rho V_{max} - |\underline{\rho} \cdot \underline{x}|$ (96)

$E = \rho \epsilon (1 - V^2_{max})^{1/2}$ (97)

(b) Go to AFILT31

3.11 AFILT31 FORMULATION

Subroutine used by AFILT3

(1) If $\delta \geq 0$ the satellite is visible (98)

(2) If $\delta < 0$ the satellite is invisible (99)

(3) If $|\delta| < E$ the satellite is marginally visible (100)

SECTION 4

OPERATING INSTRUCTIONS AND COMPUTER REQUIREMENTS

The OBSERV module is programmed for the Philco 2000 computer. This section describes the tape setup, deck setup, input options and output formats.

4.1 GENERAL

This program has two modes of execution: (1) in conjunction with the Semi-Automatic System job-schedule mode of operation, where the normal operating procedures required for this mode are described in Section 2 of reference 3; and (2) the manual mode of operation which obtains input from the console typewriter instead of the SCHEDULE TAPE.

Input quantities are to specify which sensor is to be provided acquisition coordinates, which satellites are to be observed and the time period which calculations are to cover. The data are calculated and stored in core and on magnetic tape for one satellite at a time. Note that any or all types of acquisition models can be combined in the same case.

For one satellite, output data for the visual passes only and all the predictions for one pass may be printed in chronological order without being mixed with predictions for other satellites.

Due to changes in system operating procedures, OBSERV has become somewhat like a main sequence program, which reverses the original design specifications. Therefore, the program has been modified so that it may be run in the manual mode. In this mode the program may be called big using the console typewriter. The input is the same as for option 0 in the schedule tape mode except that the base day and base message numbers are typed in. Most of the changes are primarily concerned with input data processing.

4.2 TAPE SETUP

Tape assignments are displayed in Figure 5. When OBSERV is run in the manual mode of operation the SCHEDULE TAPE (logical 2) is not used.

4.3 DECK SETUP

For both modes of operation (schedule and manual), the FAN TAPE (logical 0) is generated from punched cards on the Philco 1000 in read-code mode with sense option on. Nine types of cards are used (see Figure 6):

CARD TYPE		CONTENT
1		"FANCARDS" Card
2	case data cards	Control Card
3	case data cards	Fan/Tracker Card
4	case data cards	"FROM" Address Card
5	case data cards	"INFO" Address Card
6	case data cards	"TO" Address Card
7	case data cards	"ALL", "ALL BUT", or "ONLY" Card
8		ENDCASE Card
9		ENDSCHED Card

Explanation of card types:

TYPE	DESCRIPTION
1	Used as the Tape Identifier. See Figure II-1
2	Must always be used and specifies data about the sensor, the calculations and the output. Fields 11 and 12 are used in the headings of the printed output. See Figure II-2

Logical Unit		Tape Identification	Description
0		FANCARDS	FAN TAPE - Input
1		70 BINMST	SPS B-2 Master
2		70△ SCHTP	SCHEDULE TAPE - Input (Not required in manual mode)
4		70△ SEAI1	Sensor, Element Acquisition Information Communication Files
7	(write ring in)	SCRATCH	SCRATCH
8	(write ring in)	SCRATCH	SCRATCH
9	(write ring in)	SCRATCH	SCRATCH
11	(write ring in)	70 ØUTPUT	OUTPUT

FIGURE 5. TAPE SETUP FOR OBSERV

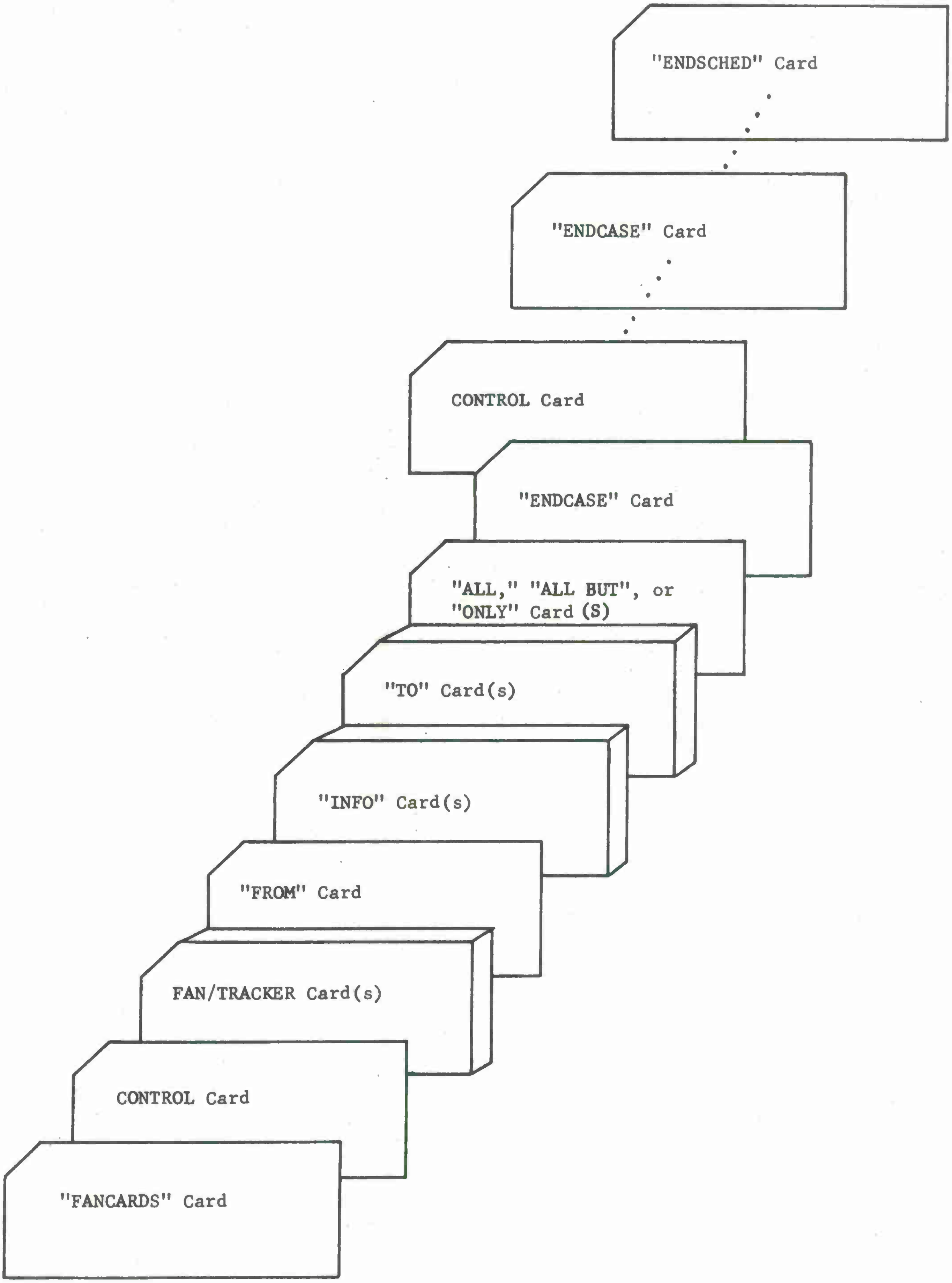


FIGURE 6. DECK SETUP FOR FAN TAPE - (LOGICAL 0)

Type	Description
3	FAN Card - used to specify data for fixed beam surveillance sensors. As many as two fixed beams or fans may be specified on one card. A maximum of fifteen cards, specifying no more than 30 beams can be used. See Figure II-3.
	TRACKER Card - used to specify data for a sensor with tracking capability. This card, one per sensor, must have a " Δ-99.0" punched in the first field. Any number 2 thru 8 points may be specified per satellite pass. If 9 is indicated-points are spaced Δt apart. See Figure II-4.
4,5,6	The FROM card indicates the address of the sending agency. There is one of these cards per case. The first TO card shows the address of the sensor to which the teletype message will be sent. This station has primary interest and maintains control over the message received. Other stations or persons may also be sent this message. They are indicated on a TO card if they have a secondary interest in the message. If the message is sent for information only then an INFO card is used. The total of INFO and TO cards cannot exceed nine per case. Columns 1-64 of the Address card are positioned on the DE line of the output, while those for the TO and INFO cards are positioned on the preceding line of the message in the format required by the automatic routing equipment. See Figure II-5.

Type	Description
7	Specifies the satellites to be used. The ALL card indicates <u>all</u> satellites are to be used in the run. The ALL BUT card indicates <u>all</u> <u>but</u> the satellites specified in the variable field beginning in Column 9 are to be run. The ONLY card indicates <u>only</u> the ones specified in the variable field are to be run. The satellite numbers are specified by five digit numerics separated by commas. A range of satellites may also be specified. For example, assume satellites 00004, 00005, 00006, 00007, are to be run. This may be specified on an ONLY card in one of two ways: ONLY 00004, 00005, 00006, 00007, ONLY 00004 - 00007 Data can continue on subsequent cards, the data beginning in Column 1. See Figure II-6.
8,9	Both cards have 11-8-2 punch in Column 9 for END BLOCK Control and both are the same as those used on Schedule Tape jobs. END CASE - separates each group of Case Data Cards. ENDSCHED - the last card in the deck.

The required order of cards to be used for the FAN Input Data Tape is as follows:

TYPE	CONTENT
1	"FANCARDS" Card
2-7	Case Data Cards

Type	Content
8	END CASE Card
2-7	Case Data Cards
8	END CASE Card
.	.
.	.
.	.
9	ENDSCHED Card

The Case Data Cards are arranged in the following order:

TYPE	CONTENT	COMMENT
2	Control Card	One per case
3	Fan/Tracker Cards	One Tracker card and/or any number of fan cards the total not to exceed 30 fans.
4	"FROM" Card	One per case
5	"TO" Card	Up to nine per case with limitation that the sum of "TO" and "INFO" Cards cannot exceed nine.
6	Either "ALL", "ALL BUT" or "ONLY"	One per case; additional satellite specifiers can follow "ALL BUT" and "ONLY" Cards.

For schedule mode of operation the SCHEDULE TAPE (logical 2) is generated from punched cards in the same manner as the FAN TAPE is generated (see Figure 7). The cards are as follows:

ID Card
JOB Card
REM Card (optional)
SPS JOB Card
Parameter (Base-Time) Card
Data Cards (for options 1, 2, 3, 4, and 5 only) -
    Element, Sensor, etc.
ENDOFJOB Card

The ID, JOB, REM, ENDOFJOB, ENDSCHED and the END CASE Cards are described in Section 5.4 of reference 3.

The parameter (Base-Time) Card is depicted in Figure II-7

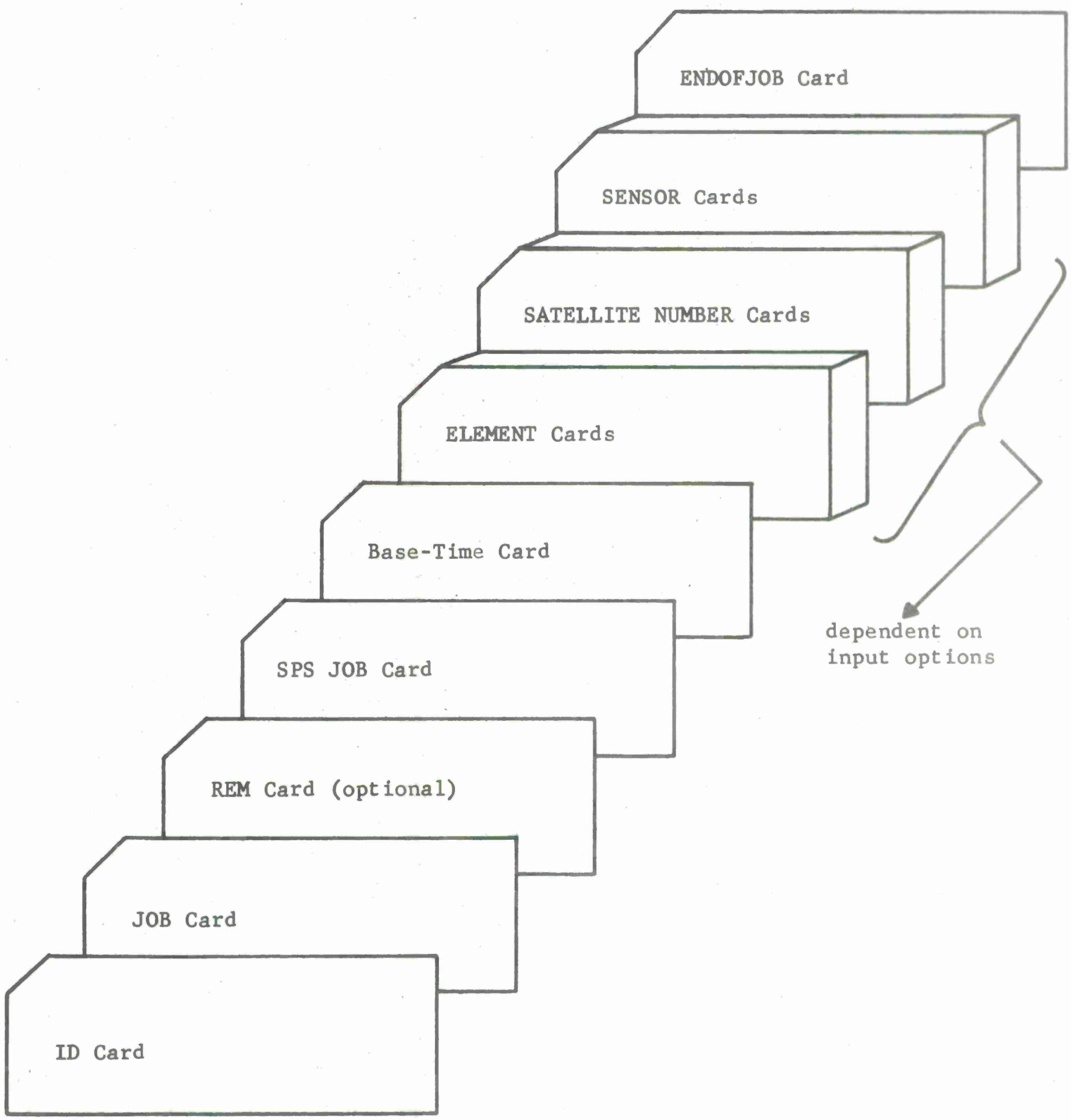


FIGURE 7. DECK SETUP FOR SCHEDULE TAPE - (LOGICAL 2)

4.4 INPUT OPTIONS

The program allows six input options while in the schedule tape mode of operation. The input option designates whether required data will come from the input tape or from standard system files.

TABLE I INPUT OPTIONS

	Tape 4 (SEAI)		Tape 2 (SCHEDULE)			
INPUT OPTION	E-FILE	S-FILE	PARAMETER CARDS	ELEMENT CARDS	SATELLITE NUMBER CARDS	SENSOR CARDS
0	*	*	Yes	No	No	No
1		*	Yes	Yes	No	No
2	*	*	Yes	No	Yes	No
3			Yes	Yes	No	Yes
4	*		Yes	No	Yes	Yes
5	*		Yes	No	No	Yes

*Use of these files is implied with this option.

Notes: (1) Parameter card - This card specifies the base day and base message number.

(2) E-File - This file on the SEAI tape contains the elements of all satellite orbits.

(3) S-File - File on the SEAI tape which contains the coordinates of all the sensors.

(4) Element Cards - Each set of six cards contains the elements of any given satellite orbit.

(5) Satellite Number Cards - These cards contain the numbers of satellites whose elements are to be obtained from the E-File.

(6) Sensor Cards - These cards contain the coordinates of any one sensor.

Descriptions of the cards and tape files mentioned above can be found in Sections 5.4 and 5.5 respectively, of reference 3.

A description of each option follows:

0 - The elements of those satellite orbits on the E-File which are specified on the ALL, ALLBUT or ONLY card will be used in calculations. The coordinates of the sensor specified on the Control Card will be obtained from the S-File.

1 - The elements introduced by the Element Cards will be used in calculations. All other operations are the same as option 0.

2 - Those elements specified on the Satellite Number Cards will be read from the E-File and used for calculations. All other operations are the same as option 0.

3 - Operations are similar to option 1 except that the sensor coordinates are obtained from the Sensor Card.

4 - Operations are similar to option 2 except that the sensor coordinates are obtained from the Sensor Card.

5 - The elements of those satellite orbits on the E-File which are specified on the ALL, ALLBUT or ONLY card will be used in calculations. The sensor coordinates are obtained from the Sensor Card.

4.5 OUTPUT

a. <u>Options</u>

(1) -0- Specifies the generation of the output on printed copy and teletype tape.

(2) -1- Output is produced on printed copy only. Note that the information on the printed copy and the teletype tape are in the same order; however, the direction cosine printout is optional on hard copy but is not available for the teletype tape. When run in manual mode, option 0 is automatically specified. In the schedule mode, column 18 of the SPSJOB card specifies the option (0 or 1).

b. <u>Format</u>

Figure 8 shows the general format of the output with heading information. FAN number is optional on both hard copy and teletype tape; also, when requested for a tracker, FAN number prints "T" and for point of maximum elevation "**". Every

SAT. SUMMARY FOR STA - XXX
NNNNN, ...
DECAYING
NNNNN, ...
100 DAYS PAST EPOCH
NNNNN, ...
SAT.NO./SET NO.
NNNNN/SSSS. . . .

XXX = Station ID Number
NNNNN = Satellite Number
NNNNN = 000 if no Satellites qualify for these two categories
SSSS = Element Set Number
Hard Copy Only

ΔΔΔ
PP SSS TTTT VVVV . . . . (up to 9 addresses
DE RRRR MMMM C
CCCk
P DD/HHMMZ
FM SENDING STATION ADDRESS
TO STATION ADDRESS
INFO STATION ADDRESS
CLASSIFICATION (see below) DDD HHMM.FF

ΔΔΔ = TTY Heading for each message or after every 100 lines if TTY is requested with addressing
Priority and To and INFO Station Route Addresses
RRRRR = Sending Station Route Address; MMMM = Message Number; C = A or D
CCC = ZNR if unclassified
Current Time
Route Addresses may also be included
Current Time

LOOK ANGLE SCHEDULE FOR STATION ADDRESS

SAT	XXXX	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN No.	DIRECTION COSINES U	V	W
	DAY	DDD DD/MM/YY			(XX)					
NNN	NNNNN	HHMM.FF	±EE.E	AAA.A	RRRRR	±RR.R	NN	±.UUU	±.VVV	±.WWW
:	:	:	:	:	:	:	:	:	:	:

NO MORE DATA
DD/HHMMZ MMM RRRRR

XXXX = ELEM or REV
XX = KM or NM
Data Within Period
Hard Copy and TTY output

Current Time; Month; Sending Station Route Address
TTY Wrapup

Classification Format
UNCLAS 1SPADATLAS
CONFIDENTIAL 1SPADATLAS
SECRET 1SPADATLAS
SECRETNOFORN 1SPADATLAS
SECRET RELEASABLE OUTSIDE SSO CHANNELS 1SPADATLAS

NOTES: Underlined quantities are of fixed format and are printed as shown.

This Format is subject to change without notice in order to comply with Military Network changes.

FIGURE 8 OBSERVING SCHEDULE PROGRAM OUTPUT FORMAT

effort has been made to ensure that teletype headings conform with the procedure presently established for use within the military networks. The RANGE may print "0" kilometers - this indicates that the actual range was greater than 16,383 km. and could not be contained in the internal packed format.

c. Satellite Summary

The satellite summary output routine has been retained which lists the satellites being used and their corresponding element set numbers. This is printed on the hardcopy only. Special comments are printed if the predictions are more than one hundred days from epoch or if the satellite has reached decay conditions during the prediction.

d. Diagnostic Error Comments

The program may print any one of a number of diagnostic error comments some of which indicate an error in the input and others which indicate a malfunction of the program or the machine. They are nearly all self-explanatory and are intended to aid the user in the full utilization of the program. The comments which might appear are as follows:

(1) "CASE REJECTED - BASE TIME CARD MISSING OR IN ERROR". The entire job is rejected because of a faulty card or because the base time or message number was typed incorrectly.

(2) "CASE REJ-INP ERR - STA XXX" The current case only is rejected for one of the following stated reasons:

"ERROR ON ALL BUT OR ONLY CARDS".
"FAN PARAMETER (REQUEST) CARD MISSING (NO R IN COLUMN 79)."
"CHECK INPUT DATA FOR ILLEGAL CHARACTERS IN FIELDS."
"STA. NO. ON R AND F CARDS DIFFER."
"FAN CARDS MISSING (NO F IN COLUMN 79)."
"ADDRESS CARD MISSING"
"PRIORITY NOT PUNCHED IN PARAMETER (REQUEST) CARD."
"MORE THAN THIRTY RECORDS IN F TYPE CARDS"
"ALL, ALL BUT, OR ONLY CARDS MISSING"
"ROUTING DATA MISSING"
"TOO MANY ROUTE CARDS"

(3) "ERROR ON TRACKER CARD. CARD REJECTED" A tracker card is rejected for one of the following reasons:

"ONLY 1 TRACKER CARD ALLOWED"
"LIMITS ON BORESIGHT ANGLES WRONG"
"POINTS PER PASS WRONG"
"DELTA T IS ZERO"
"MAX, RANGE IS WRONG"
"MIN. ELEV. GREATER THAN 90"

(4) "ERROR IN FAN RECORD. RECORD REJECTED" A single fan record is rejected for one of the following reasons:

"FAN TYPE NOT H OR P"

"FAN ENDS TOO CLOSE TO COLINEAR"

"ELEVATION GREATER THAN 89 DEG"

"AZIMUTH LIMITS ARE EQUAL"

"MAX. RANGE IS WRONG"

(5) "SUBROUTINE ERROR FROM LOCATION XXXXX"

(6) "EXPONENT OVERFLOW FROM LOCATION XXXXX"

After printing either of the above two comments, the program continues processing at the next logical point.

4.6 PROGRAM NOTES

a. Case Bypass Option

Toggle 47 in the on position causes the program to type the sensor about to be processed and wait for a "STOP" or a "GO" type-in from the operator. A "STOP" will cause the case to be bypassed. A "GO" will cause the case to be run.

b. Point of Maximum Elevation

The point of maximum elevation is the first point calculated. If the range at the point of maximum elevation exceeds the maximum range of the tracker, the entire pass is rejected. If this point falls within the maximum range, the entire pass is retained.

c. Use of the ALL, ALL BUT, and ONLY cards.

One of these cards must be present in every set of Case Data Cards that is used to generate the Fan Input Data Tape. The content of this card is important only for input options of zero and five, because Element and Satellite Number Cards are not used. Therefore, it becomes necessary to specify which satellites are desired from the E-File.[1] This is accomplished by using an ALL, ALL BUT or ONLY card as described in Section 4.3a.

For input options 1, 2, 3 and 4, the Schedule Tape contains either Element or Satellite Number Cards to specify which satellites are to be used. Because this tape overrides the Fan Input Data Tape, any one of the ALL, ALL BUT or ONLY cards can be used since it will not be read. Therefore, whichever card is used may either be blank or contain satellite numbers.

1 Refer to Table 1 in Section 4.4

d. Use of the Satellite Summary

The information printed on the Satellite Summary is dependent on the input option. This information is particularly helpful when using input option zero. For this input, the summary lists only those satellites available on the E-File of all those requested on the ALL, ALL BUT or ONLY Cards.

However, for options 1, 2, 3, and 4 the summary prints out all the satellites on the Element or Satellite Number Cards.

e. Acquisition Buffer

Depending on the type of sensor, the acquisition buffer (Figure I-1) holds the respective constants for processing planar fans, horizontal fans, and trackers.

f. Operational Sequence

The B-3 system is initialized by depressing the "load" button on the console. This rewinds the system tape, reads the first block into core and executes a jump to cell 0.

EXECMOD1 and EXECMOD2 are then loaded into core and the tape on logical 4 is checked for proper I.D. "NEXT FUNCTION" is then typed on the console typewriter. The operator can respond to this comment in several ways. He may type "MANUAL", "EXEC", or "WRAPUP". "WRAPUP" will wrap up the output tape and rewind it in lock-out.

(1) Manual Mode

If the operator types "MANUAL" the system will request the program I.D. (OBSERV). After typing in the I.D. the system will execute the object program, which in turn will request the "BASE DAY" and "BASE MESSAGE NO." via the required input console typewriter. The operator must be certain that the data has been prestored onto a tape mounted on logical 0. Upon completion of the program, the system will again type "NEXT FUNCTION".

(2) Schedule Mode

If the operator types "EXEC" and toggle 24 is on, then the schedule tape mounted on logical unit 2 will be processed. A schedule tape program is requested by using an "SPSJOB" card. Such a request causes the system to load EXECMOD3 into core. EXECMOD3 then converts the input data and places it in the proper buffers. It then returns control to EXECMOD2 which loads the object program and executes it. When all the jobs on the schedule tape have been completed, the system again types "NEXT FUNCTION".

SECTION 5

PROGRAM TEST CASE

The test case included in this section illustrates many of the features of the modified program. The input data are shown in Figure 9 and the output in Figure 10.

The satellites which were used exhibit a wide variety of characteristics. Satellite 00001 has a period of approximately 20 hours and a small eccentricity; satellite 00002 has a very high eccentricity (0.7); and satellite 00003 a very low inclination (1.0°). Satellite 00004 has a very small perigee height; satellite 00005 has a high drag; and satellites 00006 and 00007 have typical direct and retrograde orbits, respectively. The sensor used is located at 30° north latitude and 90° west longitude.

The acquisition model is a complex one consisting of a composite of each of the different types. It contains the following:

(1) A phased-array tracker configuration with the boresight oriented at an elevation of 45° and azimuth of 180°. The limits imposed are 1° in elevation, 60° in α and β, (alpha and beta are respectively, the compliments of the angles between the range vector and the primary and tertiary topocentric reference vectors) and 70° in off-boresight angle.

(2) A horizontal fan at an elevation of 5° extending only within the tracker limits

(3) A series of five planar fans which form a crude "S" centered about the boresight vector. This figure ranges in azimuth from 140° to 220° and in elevation from 25° to 65°.

PLANAR FANS

Fan #	Beg. Elev.	Beg. Az	End. Elev.	End. Az
1	65°	140°	65°	220°
2	65°	220°	45°	220°
3	45°	140°	45°	220°
4	45°	140°	25°	140°
5	25°	140°	25°	220°

(4) The point of maximum elevation is also requested and is printed regardless of elevation or azimuth.

No range test is requested, nor is a visual only test or up-pass only. It is requested that the passes not be interlaced.

The output shows the acquisition data for all satellites except 00001 and 00003. Satellite 00001 has a large period and was not positioned correctly for acquisition during the period of interest. Satellite 00003 has too low an inclination for the sensor location.

The output data for satellite 00002 shows the advantage of using maximum elevation as opposed to closest approach. One may note from the range-rate values that frequently such a satellite does not have a closest approach point during a complete pass.

The pass which satellite 00007 makes on revolution 994 illustrates well the use of the composite acquisition model. Observe that it rises through the lower tracker boundary, penetrates the horizontal fan, passes through 3 segments of the "S" configuration, reaches maximum elevation, and finally leaves the tracker coverage at one of the "corners".

The pass which satellite 00006 makes on revolution 899 illustrates the program's ability to detect very short passes. (Note that the

point of maximum elevation is not within the tracker coverage.) The period of time during which the satellite is within the tracker coverage is only .63 minutes.

```
                   JOB      OBSERV TEST CASE
                   REM      AS IN DOCUMENTATION
SPSJOB  OBSERV  30
    250           25                                                                      BP
0333 300000   900000    300           OBSERV TEST SENSOR                                   S
1 00001 U     10              0000  166.8     100 4250             000000   0          10E
2 00001 38644.00000000  30.0000 254.9999  59.9999 .0009999   9.9999                   10E
3 00001  1.19841762  .000000000  -.02001   .03912  0000000                             10E
4 00001  0000000000                                                                    10E
5 00001  5.86986988  000000000  000000000                                              10E
6 00001 12015844+4  0000000    31023    200 100 5021921                                10E
1 00002 U     20              0000 0 41.1    200 4245              000000   0          20E
2 00002 38639.00000000 334.9999  40.0000  44.9999 .6999999  40.0000                   20E
3 00002  2.42731506  .000000001  -.31076   .39231 -23567-9                             20E
4 00002  0000000000                                                                    20E
5 00002  3.66666663 -2880464-8  282854-17                                              20E
6 00002 59324807+3 -09999-9      642    200 100 41012 4                                20E
1 00003 U     30              0000 0  6.1    300 4240              000000   0          30E
2 00003 38634.00000000 354.9999  30.0000  35.0000 .0009999    .9999                   30E
3 00003 16.26752414  .000004304 -8.94240 17.88071 -35249-6                             30E
4 00003  0000000000                                                                    30E
5 00003  1.03103103 -3637922-6 -734870-11                                              30E
6 00003 88519923+2 -09999-8      191    300 100 40902 3                                30E
1 00004 U     40 58  ALP   1 0000 0  6.3    400 4235              000000   0          40E
2 00004 38629.00000000 354.9999  30.0000  35.0000 .0009999  40.0000                   40E
3 00004 15.81261142  .000003953 -6.40843  8.09006 -33305-6                             40E
4 00004  0000000000                                                                    40E
5 00004  1.05105104 -3504045-6 -379921-11                                              40E
6 00004 91066551+2 -09999-8      321    400 100 40828 7                                40E
1 00005 U     50 58  BET   2 0000 0  6.5    500 4245              000000   0          50E
2 00005 38639.00000000 325.0000  59.9999 134.9999 .0009999  30.0000                   50E
3 00005 15.15600388  .001740700 -6.56358 10.42109 -15298-3                             50E
4 00005  0000000000                                                                    50E
5 00005  1.08108107 -1655527-3 -5019476-6                                              50E
6 00005 95011852+2 -50000-6      512    500 100 4090714                                50E
1 00006 U     60              0000 0  6.9    600 4230              000000   0          60E
2 00006 38624.00000000 245.0000  74.9999 269.9999 .0200000  79.9999                   60E
3 00006 14.33633205  .000147327 -1.15575 -2.82611 -13427-4                             60E
4 00006  0000000000                                                                    60E
5 00006  1.12244899 -1537982-4 -2945666-8                                              60E
6 00006 10044410+3 -50000-7      658    600 100 4082323                                60E
1 00007 U     70              0000 0  6.9    700 4230              000000   0          70E
2 00007 38624.00000000 245.0000  74.9999 269.9999 .0200000  99.9999                   70E
3 00007 14.33633205  .000147327  1.15575 -2.82611 -13427-4                             70E
4 00007  0000000000                                                                    70E
5 00007  1.12244899 -1537982-4 -2945666-8                                              70E
6 00007 10044410+3 -50000-7      658    700 100 4082323                                70E
ENDOFJOBR
ENDSCHEDR
```

FIGURE 9 Input Data for Test Case (1 of 2)

```
FANCARDSP
 333      0.0     1.0         .08196411 ORR 0 0 1 0 1        1     45      180 0          RP
 -99.0                 1.09 1        2.0 .8662 .8662  70.0                        333     FP
   5.0 120.0               240.0         HH                                                FP
  65.0 140.0          65.0 220.0         1P   65.0 220.0           45.0 220.0            2PFP
  45.0 140.0          45.0 220.0         3P   45.0 140.0           25.0 140.0            4PFP
  25.0 140.0          25.0 220.0         5P                                                FP
AERONUTRONIC DIV.  PHILCO CORP.                                        PHILCO  FROM333A
SPACETRACK R AND D FACILITY 496L SPO  ESD  AFSC                        496LSPO TO  333A
FIRST AEROSPACE CONTROL SQUADRON  ADC                                  ONEAERO INFO333A
ONLY     00001-00007
END CASER
ENDSCHEDR
```

FIGURE 9 (2 of 2)

```
BEGIN SCHED. TAPE
                    JOB         OBSERV TEST CASE
                    REM         AS IN DOCUMENTATION
SPSJOB  OBSERV  30

                                                      START   OBSERV
                                                      01-04-04-04.0

AERONUTRONIC DIV.  PHILCO CORP.                       PHILCO  FROM333A
SPACETRACK R AND D FACILITY 496L SPO  ESD  AFSC       496LSPO TO  333A
FIRST AEROSPACE CONTROL SQUADRON  ADC                 ONEAERO INFO333A

SAT. SUMMARY FOR STA-333

00001-00007

DECAYING

00000

100 DAYS PAST EPOCH

00000

SAT.NO./SET NO.

00001/0010  00002/0020  00003/0030  00004/0040  00005/0050  00006/0060  00007/0070

      *0
RR 496LSPO ONEAERO      *0
DE PHILCO 25H 04/0408Z *0
ZNR*
R 040408Z ZEX   *0
FM AERONUTRONIC DIV.  PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO  ESD  AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON  ADC
AFGRNO*
BT
```

FIGURE 10 Output Data for Test Case (1 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00002	212	0030.31	21.1	248.2	0	3.2	T	.010	.866	.500
00002	212	0031.48	21.2	247.7	0	3.1	T	.006	.863	.506
00002	212	0033.48	21.3	246.9	0	3.1	T	-.002	.857	.515
00002	212	0035.48	21.4	246.0	0	3.1	T	-.010	.851	.526
00002	212	0037.48	21.5	245.3	0	3.1	T	-.016	.845	.534
00002	212	0039.48	21.5	244.5	0	3.0	T	-.024	.840	.542
00002	212	0041.48	21.6	243.8	0	3.0	T	-.030	.834	.551
00002	212	0042.03	21.6	243.6	0	3.0	**	-.032	.833	.553
00002	212	0043.48	21.6	243.2	0	3.0	T	-.036	.830	.557
00002	212	0045.48	21.5	242.5	0	2.9	T	-.045	.825	.563
00002	212	0047.48	21.5	241.9	0	2.9	T	-.051	.821	.569
00002	212	0049.48	21.4	241.4	0	2.9	T	-.057	.817	.573
00002	212	0051.48	21.4	240.8	0	2.8	T	-.063	.813	.579
00002	212	0053.48	21.3	240.3	0	2.8	T	-.070	.809	.583
00002	212	0055.48	21.2	239.8	0	2.8	T	-.076	.806	.587
00002	212	0057.48	21.1	239.4	0	2.7	T	-.081	.803	.590
00002	212	0059.48	20.9	238.9	0	2.7	T	-.089	.800	.593
00002	212	0101.48	20.8	238.5	0	2.7	T	-.094	.797	.596
00002	212	0103.48	20.7	238.1	0	2.6	T	-.100	.794	.599
00002	212	0105.48	20.5	237.8	0	2.6	T	-.105	.793	.601
00002	212	0107.48	20.4	237.4	0	2.6	T	-.111	.790	.604
00002	212	0109.48	20.2	237.1	0	2.5	T	-.116	.788	.605
00002	212	0111.48	20.0	236.8	0	2.5	T	-.122	.786	.606
00002	212	0113.48	19.9	236.4	0	2.5	T	-.127	.783	.609
00002	212	0115.48	19.7	236.2	0	2.4	T	-.132	.782	.609
00002	212	0117.48	19.5	235.9	0	2.4	T	-.138	.781	.610
00002	212	0119.48	19.3	235.6	0	2.4	T	-.143	.779	.611
00002	212	0121.48	19.1	235.4	0	2.4	T	-.148	.778	.611
00002	212	0123.48	18.9	235.1	0	2.3	T	-.154	.776	.612
00002	212	0125.48	18.7	234.9	0	2.3	T	-.158	.775	.612
00002	212	0127.48	18.5	234.7	0	2.3	T	-.163	.774	.612
00002	212	0129.48	18.3	234.5	0	2.2	T	-.168	.773	.612
00002	212	0131.48	18.1	234.3	0	2.2	T	-.172	.772	.612
00002	212	0133.48	17.9	234.1	0	2.2	T	-.177	.771	.612
00002	212	0135.48	17.7	234.0	0	2.1	T	-.181	.771	.611
00002	212	0137.48	17.4	233.8	0	2.1	T	-.187	.770	.610
00002	212	0139.48	17.2	233.6	0	2.1	T	-.192	.769	.610
00002	212	0141.48	17.0	233.5	0	2.1	T	-.195	.769	.609
00002	212	0143.48	16.8	233.3	0	2.0	T	-.200	.768	.609
00002	212	0145.48	16.5	233.2	0	2.0	T	-.205	.768	.607
00002	212	0147.48	16.3	233.1	0	2.0	T	-.209	.768	.606
00002	212	0149.48	16.1	233.0	0	1.9	T	-.213	.767	.605
00002	212	0151.48	15.9	232.9	0	1.9	T	-.217	.767	.604
00002	212	0153.48	15.6	232.8	0	1.9	T	-.222	.767	.602
00002	212	0155.48	15.4	232.7	0	1.9	T	-.225	.767	.601
00002	212	0157.48	15.1	232.6	0	1.8	T	-.230	.767	.599
00002	212	0159.48	14.9	232.5	0	1.8	T	-.234	.767	.598
00002	212	0201.48	14.7	232.4	0	1.8	T	-.238	.766	.597
00002	212	0203.48	14.4	232.3	0	1.8	T	-.243	.766	.595

FIGURE 10 (2 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00002	212	0205.48	14.2	232.2	0	1.7	T	-.247	.766	.594
00002	212	0207.48	13.9	232.2	0	1.7	T	-.251	.767	.591
00002	212	0209.48	13.7	232.1	0	1.7	T	-.255	.767	.589
00002	212	0211.48	13.5	232.0	0	1.6	T	-.258	.766	.588
00002	212	0213.48	13.2	232.0	0	1.6	T	-.262	.767	.585
00002	212	0215.48	13.0	231.9	0	1.6	T	-.266	.767	.584
00002	212	0217.48	12.7	231.9	0	1.6	T	-.270	.768	.581
00002	212	0219.48	12.5	231.8	0	1.5	T	-.274	.767	.580
00002	212	0221.48	12.2	231.8	0	1.5	T	-.278	.768	.577
00002	212	0223.48	12.0	231.7	0	1.5	T	-.282	.768	.576
00002	212	0225.48	11.7	231.7	0	1.5	T	-.286	.768	.573
00002	212	0227.48	11.5	231.7	0	1.4	T	-.288	.769	.570
00002	212	0229.48	11.3	231.6	0	1.4	T	-.292	.769	.569
00002	212	0231.48	11.0	231.6	0	1.4	T	-.296	.769	.566
00002	212	0233.48	10.8	231.6	0	1.4	T	-.299	.770	.564
00002	212	0235.48	10.5	231.5	0	1.3	T	-.304	.770	.562
00002	212	0237.48	10.3	231.5	0	1.3	T	-.307	.770	.560
00002	212	0239.48	10.0	231.5	0	1.3	T	-.311	.771	.556
00002	212	0241.48	9.8	231.5	0	1.3	T	-.313	.771	.554
00002	212	0243.48	9.5	231.5	0	1.3	T	-.317	.772	.551
00002	212	0245.48	9.3	231.5	0	1.2	T	-.320	.772	.549
00002	212	0247.48	9.0	231.4	0	1.2	T	-.325	.772	.546
00002	212	0249.48	8.8	231.4	0	1.2	T	-.328	.772	.544
00002	212	0251.48	8.5	231.4	0	1.2	T	-.332	.773	.541
00002	212	0253.48	8.3	231.4	0	1.1	T	-.334	.773	.539
00002	212	0255.48	8.0	231.4	0	1.1	T	-.338	.774	.535
00002	212	0257.48	7.8	231.4	0	1.1	T	-.341	.774	.533
00002	212	0259.48	7.5	231.4	0	1.1	T	-.345	.775	.530
00002	212	0301.48	7.3	231.4	0	1.0	T	-.348	.775	.527
00002	212	0303.48	7.0	231.4	0	1.0	T	-.352	.776	.524
00002	212	0305.48	6.8	231.4	0	1.0	T	-.354	.776	.522
00002	212	0307.48	6.5	231.4	0	1.0	T	-.358	.776	.518
00002	212	0309.48	6.3	231.4	0	1.0	T	-.361	.777	.516
00002	212	0311.48	6.0	231.4	0	.9	T	-.365	.777	.513
00002	212	0313.48	5.8	231.4	0	.9	T	-.367	.778	.510
00002	212	0315.48	5.5	231.4	0	.9	T	-.371	.778	.507
00002	212	0317.48	5.3	231.4	0	.9	T	-.374	.778	.505
00002	212	0319.48	5.0	231.4	0	.8	T	-.378	.779	.501
00002	212	0320.16	5.0	231.4	0	.8	W	-.378	.779	.501
00002	212	0321.48	4.8	231.4	0	.8	T	-.380	.779	.499
00002	212	0323.48	4.5	231.4	0	.8	T	-.384	.779	.495
00002	212	0325.48	4.3	231.4	0	.8	T	-.387	.779	.493
00002	212	0327.48	4.1	231.4	0	.7	T	-.389	.780	.491
00002	212	0329.48	3.8	231.4	0	.7	T	-.393	.780	.487
00002	212	0331.48	3.6	231.4	0	.7	T	-.396	.780	.485

BT

FIGURE 10 (3 of 13)

*0
RR 496LSPO ONEAERO *0
DE PHILCO 26H 04/0408Z**0
ZNR*
R 040408Z ZEX *0
FM AERONUTRONIC DIV. PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO ESD AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON ADC
AFGRNC*
BT
UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION	COSINES	
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00002	212	0333.48	3.3	231.4	0	.7	T	-.400	.780	.481
00002	212	0335.48	3.1	231.4	0	.7	T	-.402	.780	.479
00002	212	0337.48	2.8	231.4	0	.6	T	-.406	.781	.475
00002	212	0339.48	2.6	231.4	0	.6	T	-.409	.781	.473
00002	212	0341.48	2.3	231.5	0	.6	T	-.411	.782	.468
00002	212	0343.48	2.1	231.5	0	.6	T	-.414	.782	.466
00002	212	0345.48	1.8	231.5	0	.6	T	-.418	.782	.462
00002	212	0347.48	1.6	231.5	0	.5	T	-.420	.782	.460
00002	212	0349.48	1.4	231.5	0	.5	T	-.423	.782	.457
00002	212	0351.48	1.1	231.5	0	.5	T	-.427	.782	.454
00002	212	0352.66	1.0	231.5	0	.5	T	-.428	.782	.452
00007	987	0037.00	11.2	93.4	2091	-.3	**	.096	-.979	.178
00007	987	0039.07	8.8	118.8	2232	2.5	T	-.228	-.866	.445
00007	987	0040.51	5.1	133.0	2512	3.9	T	-.417	-.728	.543
00007	987	0040.56	5.0	133.4	2522	3.9	H	-.422	-.724	.546
00007	987	0041.96	1.0	143.8	2894	4.8	T	-.558	-.591	.583
00007	988	0216.22	51.1	298.0	897	-.9	T	.759	.554	.342
00007	988	0216.43	51.5	288.2	890	-.2	**	.691	.591	.416
00007	988	0217.52	42.2	245.9	998	3.3	T	.261	.676	.689
00007	988	0219.52	19.5	218.9	1593	6.0	T	-.283	.592	.755
00007	988	0221.52	6.7	210.9	2360	6.6	T	-.520	.510	.685
00007	988	0221.88	5.0	210.0	2505	6.7	H	-.548	.498	.672
00007	988	0222.82	1.0	208.2	2884	6.8	T	-.611	.472	.635
00004	639	0342.48	1.0	187.1	1963	-5.1	T	-.689	.124	.714
00004	639	0342.70	1.6	185.1	1897	-4.9	T	-.684	.089	.724
00004	639	0343.88	5.0	171.5	1588	-3.6	H	-.635	-.147	.758
00004	639	0344.70	7.0	159.2	1440	-2.3	T	-.570	-.352	.742
00004	639	0345.80	8.1	139.4	1362	.0	**	-.432	-.644	.631
00004	639	0346.70	7.3	123.0	1416	1.9	T	-.292	-.832	.472
00004	639	0346.92	6.9	119.3	1444	2.4	T	-.259	-.866	.428
00007	989	0354.18	2.2	304.0	2929	-.3	**	.422	.828	-.368
00004	640	0516.56	1.0	240.0	1967	-7.0	T	-.341	.866	.366
00004	640	0517.11	3.3	240.0	1736	-7.0	T	-.312	.865	.394
00004	640	0519.11	17.4	240.3	911	-6.6	T	-.123	.829	.546
00004	640	0521.01	84.0	243.0	331	-.7	**	.670	.093	.737
00004	640	0521.11	88.3	51.2	329	.2	T	.720	-.023	.694
00004	640	0521.66	52.1	60.2	411	4.3	T	.774	-.533	.342
00004	641	0656.99	16.6	344.9	940	-.0	**	.856	.250	-.452
00004	642	0833.35	10.7	1.4	1199	-.0	**	.826	-.024	-.563

FIGURE 10 (4 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00002	213	0851.93	1.0	197.8	8065	-6.2	T	-.661	.306	.685
00002	213	0852.10	1.1	197.6	8000	-6.2	T	-.660	.302	.687
00002	213	0854.10	2.5	194.3	7248	-6.3	T	-.654	.247	.715
00002	213	0856.10	3.9	190.2	6489	-6.3	T	-.646	.177	.742
00002	213	0857.55	5.0	186.6	5941	-6.3	W	-.638	.115	.761
00002	213	0858.10	5.4	185.0	5735	-6.2	T	-.635	.087	.768
00002	213	0900.10	6.7	178.1	5002	-5.9	T	-.619	-.033	.784
00002	213	0902.10	7.6	168.9	4322	-5.3	T	-.594	-.191	.781
00002	213	0903.33	7.9	161.6	3952	-4.7	••	-.567	-.313	.762
00002	213	0904.10	7.8	156.4	3749	-4.1	T	-.546	-.397	.738
00002	213	0906.10	6.2	140.2	3365	-2.1	T	-.464	-.636	.616
00002	213	0906.93	5.0	132.6	3284	-1.1	W	-.415	-.733	.538
00002	213	0908.10	2.5	121.6	3262	.5	T	-.339	-.851	.401
00002	213	0908.27	2.1	119.9	3269	.7	T	-.326	-.866	.378
00006	892	0957.33	1.0	164.7	3389	-6.0	T	-.670	-.264	.694
00006	892	0957.40	1.3	164.5	3363	-6.0	T	-.665	-.267	.697
00006	892	0958.42	5.0	161.7	3001	-5.8	W	-.607	-.313	.730
00006	892	0959.40	9.0	158.2	2663	-5.6	T	-.538	-.367	.759
00006	892	1001.40	18.9	147.1	2027	-4.8	T	-.333	-.514	.791
00006	892	1003.40	30.9	124.6	1551	-2.8	T	.019	-.706	.708
00006	892	1005.03	36.3	92.6	1407	.0	••	.393	-.805	.444
00006	892	1005.40	35.9	84.4	1416	.7	T	.471	-.806	.359
00006	892	1005.48	35.8	82.9	1419	.9	T	.485	-.805	.343
00004	643	1009.67	19.6	17.8	828	-.0	••	.871	-.288	-.397
00005	582	1045.95	1.0	213.7	2496	-5.7	T	-.576	.555	.601
00005	582	1047.14	5.0	206.5	2104	-5.2	W	-.569	.444	.692
00005	582	1047.58	6.6	203.1	1969	-5.0	T	-.565	.390	.727
00005	582	1049.58	14.0	179.8	1482	-2.8	T	-.515	-.003	.857
00005	582	1051.07	16.7	153.5	1351	.0	••	-.403	-.427	.809
00005	582	1051.58	16.4	143.7	1368	1.1	T	-.347	-.568	.746
00005	582	1053.22	11.7	117.8	1616	3.8	T	-.180	-.866	.466
00006	893	1139.13	1.0	220.2	3405	-5.5	T	-.528	.645	.552
00006	893	1139.24	1.3	220.6	3370	-5.5	T	-.521	.651	.553
00006	893	1140.34	5.0	225.0	3011	-5.3	W	-.436	.704	.560
00006	893	1141.24	8.2	229.4	2733	-5.0	T	-.355	.751	.556
00006	893	1143.24	16.1	243.6	2190	-3.9	T	-.106	.861	.498
00006	893	1143.34	16.5	244.6	2165	-3.8	T	-.090	.866	.492
00006	893	1146.49	25.0	285.5	1762	-.0	••	.470	.873	.128
00004	644	1144.51	33.2	274.3	558	-5.2	T	.432	.834	.343
00004	644	1145.19	52.3	240.4	400	-2.1	T	.346	.532	.773
00004	644	1145.38	55.7	220.1	384	-.6	2	.279	.363	.889
00004	644	1145.47	55.9	210.1	383	.1	••	.243	.281	.928
00004	644	1145.71	52.5	183.8	399	2.0	3	.131	.040	.990
00004	644	1146.74	25.8	142.6	672	5.9	5	-.198	-.547	.814
00004	644	1147.19	19.0	137.6	839	6.4	T	-.264	-.638	.724
00004	644	1148.97	5.0	129.9	1560	6.9	W	-.390	-.764	.513
00004	644	1149.19	3.9	129.4	1649	6.9	T	-.400	-.771	.496
00004	644	1149.86	1.0	128.4	1931	7.0	T	-.427	-.784	.451
00007	993	1147.56	15.9	63.6	2209	.0	••	.496	-.861	-.109

FIGURE 10 (5 of 13)

UNCLAS SPACETRACK 4 0408.80

LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00005	583	1227.26	9.5	241.4	1759	-6.4	T	-.217	.866	.451
00005	583	1228.14	15.2	238.0	1427	-6.1	T	-.176	.818	.547
00005	583	1230.14	38.6	214.6	779	-4.0	T	-.014	.444	.896
00005	583	1231.15	52.0	168.9	636	-.3	3	.130	-.119	.984
00005	583	1231.22	52.1	164.5	635	-.0	**	.139	-.164	.977
00005	583	1232.14	41.5	119.2	740	3.5	T	.210	-.654	.727

BT

FIGURE 10 (6 of 13)

*0
RR 496LSPO ONEAERO *0
DE PHILCO 27H 04/0408Z**0
ZNR*
R 040408Z ZEX *0
FM AERONUTRONIC DIV. PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO ESD AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON ADC
AFGRMC*
BT
UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00005	583	1233.02	27.9	101.3	979	5.2	T	.208	-.867	.453
00007	994	1318.05	1.0	173.1	3391	-6.4	T	-.690	-.120	.714
00007	994	1318.52	2.7	173.7	3211	-6.4	T	-.669	-.110	.735
00007	994	1319.08	5.0	174.4	2993	-6.4	W	-.639	-.097	.763
00007	994	1320.52	11.8	176.8	2451	-6.2	T	-.546	-.055	.836
00007	994	1322.52	25.4	183.1	1736	-5.6	T	-.335	.049	.941
00007	994	1323.13	31.2	186.6	1539	-5.2	5	-.235	.098	.967
00007	994	1324.52	48.6	202.8	1170	-3.4	T	.099	.256	.961
00007	994	1324.60	49.9	204.6	1153	-3.3	3	.127	.268	.955
00007	994	1325.15	57.6	219.9	1064	-2.1	2	.306	.344	.888
00007	994	1325.90	63.3	255.6	1015	-.0	**	.553	.435	.711
00007	994	1326.52	59.8	287.0	1045	1.6	T	.715	.481	.507
00007	994	1326.99	53.7	303.1	1107	2.7	T	.798	.496	.341
00004	645	1319.45	3.4	240.2	1702	-2.1	T	-.309	.866	.393
00004	645	1320.63	4.2	222.3	1623	-.0	**	-.470	.671	.573
00004	645	1321.27	4.0	212.4	1645	1.1	T	-.546	.534	.645
00004	646	1323.09	1.0	188.2	1929	3.8	T	-.687	.143	.712
00005	584	1409.81	29.9	267.9	934	-5.7	T	.330	.866	.375
00005	584	1411.63	87.1	286.6	514	-.3	T	.716	.048	.696
00005	584	1411.71	88.6	43.8	513	.1	**	.719	-.017	.694
00005	584	1413.46	31.8	87.1	894	5.6	T	.403	-.849	.342
00007	995	1505.63	4.2	269.2	3109	.0	**	.042	.997	.062
00005	585	1550.38	29.9	268.0	932	-5.6	T	.331	.866	.374
00005	585	1550.52	32.1	267.0	887	-5.5	T	.344	.846	.407
00005	585	1552.21	70.6	191.0	541	-.0	**	.436	.063	.898
00005	585	1552.28	70.4	181.7	541	.3	1	.429	.010	.903
00005	585	1552.52	66.4	155.0	555	1.5	T	.391	-.169	.905
00005	585	1554.52	23.5	111.4	1096	6.0	T	.045	-.854	.519
00005	585	1554.65	22.0	110.9	1145	6.1	T	.031	-.866	.499
00005	586	1730.54	17.8	245.5	1302	-4.3	T	-.063	.866	.495
00005	586	1732.27	26.0	208.8	1024	-.6	T	-.247	.433	.867
00005	586	1732.49	26.2	202.8	1020	-.0	**	-.273	.348	.897
00005	586	1734.27	18.9	162.9	1257	4.0	T	-.410	-.278	.868
00005	586	1736.27	7.9	142.0	1863	5.7	T	-.455	-.610	.649
00005	586	1736.94	5.0	138.0	2101	6.0	W	-.462	-.667	.585
00005	586	1738.00	1.0	133.5	2487	6.2	T	-.474	-.725	.499
00005	587	1909.89	2.8	240.2	2308	-3.0	T	-.316	.867	.386
00005	587	1910.88	4.4	230.0	2156	-2.0	T	-.399	.764	.507
00005	587	1911.46	5.0	223.5	2099	-1.3	W	-.449	.686	.573

FIGURE 10 (7 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00005	587	1912.39	5.5	212.4	2059	-.1	**	-.527	.533	.662
00005	587	1912.88	5.4	206.5	2067	.6	T	-.563	.444	.697
00005	587	1913.49	5.0	199.4	2102	1.3	H	-.603	.331	.726
00005	587	1914.88	3.0	184.5	2284	2.9	T	-.667	.078	.741
00005	587	1915.87	1.0	175.7	2484	3.8	T	-.693	-.075	.717
00002	214	1926.27	43.9	286.9	4394	.6	T	.638	.689	.342
00002	214	1926.49	45.1	286.3	4404	.8	T	.641	.677	.361
00002	214	1928.49	55.5	280.3	4566	1.9	T	.654	.557	.511
00002	214	1930.49	64.2	271.2	4844	2.7	T	.643	.435	.630
00002	214	1932.49	70.8	257.3	5210	3.3	T	.617	.321	.719
00002	214	1934.49	74.8	237.2	5640	3.8	T	.582	.220	.783
00002	214	1936.47	76.0	214.1	6107	4.1	**	.544	.136	.828
00002	214	1936.49	76.0	213.9	6112	4.1	T	.544	.135	.828
00002	214	1938.49	75.1	194.0	6613	4.2	T	.507	.062	.860
00002	214	1940.49	73.0	180.2	7131	4.4	T	.469	.001	.883
00002	214	1942.49	70.7	171.2	7659	4.4	T	.436	-.051	.898
00002	214	1943.03	70.0	169.4	7803	4.4	1	.427	-.063	.902
00002	214	1944.49	68.3	165.3	8192	4.4	T	.404	-.094	.910
00002	214	1946.49	66.1	161.2	8724	4.4	T	.375	-.131	.918
00002	214	1948.49	64.0	158.3	9255	4.4	T	.348	-.162	.924
00002	214	1950.49	62.1	156.1	9782	4.4	T	.322	-.190	.927
00002	214	1952.49	60.4	154.5	10303	4.3	T	.300	-.213	.930
00002	214	1954.49	58.8	153.3	10818	4.3	T	.278	-.233	.932
00002	214	1956.49	57.3	152.4	11326	4.2	T	.257	-.250	.934
00002	214	1958.49	56.0	151.6	11827	4.1	T	.238	-.266	.934
00002	214	2000.49	54.8	151.1	12321	4.1	T	.221	-.279	.935
00002	214	2002.49	53.6	150.7	12806	4.0	T	.203	-.290	.935
00002	214	2004.49	52.6	150.3	13284	3.9	T	.189	-.301	.935
00002	214	2006.49	51.6	150.1	13754	3.9	T	.173	-.310	.935
00002	214	2008.49	50.6	149.9	14216	3.8	T	.158	-.318	.935
00002	214	2010.49	49.8	149.8	14671	3.7	T	.146	-.325	.935
00002	214	2012.49	49.0	149.8	15118	3.7	T	.133	-.330	.935
00002	214	2013.97	48.4	149.7	15443	3.6	3	.123	-.335	.934
00002	214	2014.49	48.2	149.7	15557	3.6	T	.120	-.336	.934
00002	214	2016.49	47.5	149.8	15989	3.6	T	.108	-.340	.934
00002	214	2018.49	46.8	149.8	0	3.5	T	.097	-.344	.934
00002	214	2020.49	46.2	149.9	0	3.4	T	.087	-.347	.934
00002	214	2022.49	45.6	150.0	0	3.4	T	.077	-.350	.934
00002	214	2024.49	45.0	150.1	0	3.3	T	.067	-.352	.933
00002	214	2026.49	44.5	150.2	0	3.3	T	.058	-.354	.933
00002	214	2028.49	44.0	150.4	0	3.2	T	.049	-.355	.933
00002	214	2030.49	43.5	150.5	0	3.2	T	.040	-.357	.933
00002	214	2032.49	43.0	150.7	0	3.1	T	.031	-.358	.933
00002	214	2034.49	42.5	150.9	0	3.1	T	.022	-.359	.933
00002	214	2036.49	42.1	151.1	0	3.0	T	.015	-.359	.933
00002	214	2038.49	41.7	151.3	0	3.0	T	.007	-.359	.933
00002	214	2040.49	41.3	151.5	0	2.9	T	.000	-.358	.934
00002	214	2042.49	40.9	151.8	0	2.9	T	-.008	-.357	.934
00002	214	2044.49	40.6	152.0	0	2.8	T	-.014	-.356	.934

FIGURE 10 (8 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00002	214	2046.49	40.2	152.2	0	2.8	T	-.021	-.356	.934
00002	214	2048.49	39.9	152.5	0	2.7	T	-.028	-.354	.935
00002	214	2050.49	39.6	152.7	0	2.7	T	-.033	-.353	.935
00002	214	2052.49	39.2	153.0	0	2.6	T	-.041	-.352	.935
00002	214	2054.49	38.9	153.2	0	2.6	T	-.047	-.351	.935
00002	214	2056.49	38.6	153.5	0	2.6	T	-.053	-.349	.936

BT

FIGURE 10 (9 of 13)

•0
RR 496LSPO ONEAERO •0
DE PHILCO 28H 04/0408Z••0
ZNR•
R 040408Z ZEX •0
FM AERONUTRONIC DIV. PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO ESD AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON ADC
AFGRNC•
BT
UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00002	214	2058.49	38.4	153.7	0	2.5	T	-.058	-.347	.936
00002	214	2100.49	38.1	154.0	0	2.5	T	-.064	-.345	.936
00002	214	2102.49	37.8	154.3	0	2.4	T	-.070	-.343	.937
00002	214	2104.49	37.6	154.6	0	2.4	T	-.075	-.340	.938
00002	214	2106.49	37.3	154.8	0	2.4	T	-.080	-.339	.937
00002	214	2108.49	37.1	155.1	0	2.3	T	-.085	-.336	.938
00002	214	2110.49	36.8	155.4	0	2.3	T	-.091	-.333	.938
00002	214	2112.49	36.6	155.7	0	2.3	T	-.096	-.330	.939
00002	214	2114.49	36.4	155.9	0	2.2	T	-.100	-.329	.939
00002	214	2116.49	36.1	156.2	0	2.2	T	-.106	-.326	.939
00002	214	2118.49	35.9	156.5	0	2.1	T	-.111	-.323	.940
00002	214	2120.49	35.7	156.8	0	2.1	T	-.115	-.320	.940
00002	214	2122.49	35.5	157.1	0	2.1	T	-.120	-.317	.941
00002	214	2124.49	35.3	157.4	0	2.0	T	-.124	-.314	.941
00002	214	2126.49	35.1	157.7	0	2.0	T	-.129	-.310	.942
00002	214	2128.49	34.9	158.0	0	2.0	T	-.133	-.307	.942
00002	214	2130.49	34.7	158.3	0	1.9	T	-.138	-.304	.943
00002	214	2132.49	34.5	158.6	0	1.9	T	-.142	-.301	.943
00002	214	2134.49	34.4	158.9	0	1.9	T	-.145	-.297	.944
00002	214	2136.49	34.2	159.1	0	1.9	T	-.149	-.295	.944
00002	214	2138.49	34.0	159.4	0	1.8	T	-.153	-.292	.944
00002	214	2140.49	33.8	159.7	0	1.8	T	-.158	-.288	.944
00002	214	2142.49	33.7	160.0	0	1.8	T	-.160	-.285	.945
00002	214	2144.49	33.5	160.3	0	1.7	T	-.165	-.281	.945
00002	214	2146.49	33.3	160.6	0	1.7	T	-.169	-.278	.946
00002	214	2148.49	33.2	160.9	0	1.7	T	-.172	-.274	.946
00002	214	2150.49	33.0	161.2	0	1.6	T	-.176	-.270	.947
00002	214	2152.49	32.8	161.5	0	1.6	T	-.181	-.267	.947
00002	214	2154.49	32.7	161.8	0	1.6	T	-.183	-.263	.947
00002	214	2156.49	32.5	162.1	0	1.6	T	-.188	-.259	.947
00002	214	2158.49	32.4	162.4	0	1.5	T	-.190	-.255	.948
00002	214	2200.49	32.2	162.7	0	1.5	T	-.194	-.252	.948
00002	214	2202.49	32.1	163.0	0	1.5	T	-.197	-.248	.949
00002	214	2204.49	31.9	163.3	0	1.5	T	-.201	-.244	.949
00002	214	2206.49	31.8	163.6	0	1.4	T	-.204	-.240	.949
00002	214	2208.49	31.6	163.9	0	1.4	T	-.208	-.236	.949
00002	214	2210.49	31.5	164.2	0	1.4	T	-.211	-.232	.950
00002	214	2212.49	31.3	164.5	0	1.3	T	-.215	-.228	.950
00002	214	2214.49	31.2	164.8	0	1.3	T	-.217	-.224	.950

FIGURE 10 (10 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE (KM)	R-RATE	FAN NO.	DIRECTION COSINES U	V	W
DAY	250	06/09/64								
00002	214	2216.49	31.0	165.1	0	1.3	T	-.222	-.220	.950
00002	214	2218.49	30.9	165.3	0	1.3	T	-.224	-.218	.950
00002	214	2220.49	30.7	165.6	0	1.2	T	-.228	-.214	.950
00002	214	2222.49	30.6	165.9	0	1.2	T	-.230	-.210	.950
00002	214	2222.72	30.6	166.0	0	1.2	5	-.231	-.208	.951
00002	214	2224.49	30.4	166.2	0	1.2	T	-.234	-.206	.950
00002	214	2226.49	30.3	166.5	0	1.2	T	-.237	-.202	.950
00002	214	2228.49	30.2	166.8	0	1.1	T	-.239	-.197	.951
00002	214	2230.49	30.0	167.1	0	1.1	T	-.243	-.193	.950
00002	214	2232.49	29.9	167.4	0	1.1	T	-.246	-.189	.951
00002	214	2234.49	29.7	167.7	0	1.1	T	-.250	-.185	.950
00002	214	2236.49	29.6	167.9	0	1.1	T	-.252	-.182	.950
00002	214	2238.49	29.5	168.2	0	1.0	T	-.254	-.178	.951
00002	214	2240.49	29.3	168.5	0	1.0	T	-.258	-.174	.950
00002	214	2242.49	29.2	168.8	0	1.0	T	-.261	-.170	.950
00002	214	2244.49	29.0	169.1	0	1.0	T	-.264	-.165	.950
00002	214	2246.49	28.9	169.3	0	.9	T	-.267	-.163	.950
00002	214	2248.49	28.8	169.6	0	.9	T	-.269	-.158	.950
00002	214	2250.49	28.6	169.9	0	.9	T	-.273	-.154	.950
00002	214	2252.49	28.5	170.2	0	.9	T	-.275	-.150	.950
00002	214	2254.49	28.3	170.5	0	.8	T	-.279	-.145	.949
00002	214	2256.49	28.2	170.7	0	.8	T	-.281	-.142	.949
00002	214	2258.49	28.1	171.0	0	.8	T	-.283	-.138	.949
00002	214	2300.49	27.9	171.3	0	.8	T	-.287	-.134	.949
00002	214	2302.49	27.8	171.5	0	.8	T	-.289	-.131	.948
00002	214	2304.49	27.6	171.8	0	.7	T	-.293	-.126	.948
00002	214	2306.49	27.5	172.1	0	.7	T	-.295	-.122	.948
00002	214	2308.49	27.4	172.3	0	.7	T	-.297	-.119	.948
00002	214	2310.49	27.2	172.6	0	.7	T	-.300	-.115	.947
00002	214	2312.49	27.1	172.9	0	.6	T	-.303	-.110	.947
00002	214	2314.49	26.9	173.1	0	.6	T	-.306	-.107	.946
00002	214	2316.49	26.8	173.4	0	.6	T	-.308	-.103	.946
00002	214	2318.49	26.6	173.6	0	.6	T	-.312	-.100	.945
00002	214	2320.49	26.5	173.9	0	.6	T	-.314	-.095	.945
00002	214	2322.49	26.4	174.2	0	.5	T	-.316	-.091	.945
00002	214	2324.49	26.2	174.4	0	.5	T	-.319	-.088	.944
00002	214	2326.49	26.1	174.7	0	.5	T	-.321	-.083	.943
00002	214	2328.49	25.9	174.9	0	.5	T	-.325	-.080	.942
00002	214	2330.49	25.8	175.2	0	.5	T	-.327	-.075	.942
00002	214	2332.49	25.6	175.4	0	.4	T	-.330	-.072	.941
00002	214	2334.49	25.5	175.7	0	.4	T	-.332	-.068	.941
00002	214	2336.49	25.3	175.9	0	.4	T	-.335	-.065	.940
00002	214	2338.49	25.2	176.1	0	.4	T	-.337	-.062	.939
00002	214	2340.49	25.0	176.4	0	.4	T	-.341	-.057	.938
00002	214	2342.49	24.9	176.6	0	.3	T	-.343	-.054	.938
00002	214	2344.49	24.7	176.9	0	.3	T	-.346	-.049	.937
00002	214	2346.49	24.6	177.1	0	.3	T	-.348	-.046	.936
00002	214	2348.49	24.4	177.3	0	.3	T	-.351	-.043	.935
00002	214	2350.49	24.3	177.6	0	.2	T	-.353	-.038	.935

FIGURE 10 (11 of 13)

UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
	DAY 250	06/09/64			(KM)		NO.	U	V	W
00002	214	2352.49	24.1	177.8	0	.2	T	-.356	-.035	.934
00002	214	2354.49	24.0	178.0	0	.2	T	-.358	-.032	.933
00002	214	2356.49	23.8	178.2	0	.2	T	-.361	-.029	.932
00002	214	2358.49	23.7	178.5	0	.2	T	-.363	-.024	.931
00006	899	2040.63	13.3	69.9	1979	-.2	**	.399	-.914	-.074
00006	899	2045.37	2.9	119.8	2726	4.7	T	-.315	-.867	.387

BT

FIGURE 10 (12 of 13)

*0
RR 496LSPO ONEAERO *0
DE PHILCO 29H 04/0408Z**0
ZNR*
R 040408Z ZEX *0
FM AERONUTRONIC DIV. PHILCO CORP.
TO SPACETRACK R AND D FACILITY 496L SPO ESD AFSC
INFO FIRST AEROSPACE CONTROL SQUADRON ADC
AFGRNC*
BT
UNCLAS SPACETRACK 4 0408.80
LOOK ANGLE SCHEDULE FOR OBSERV TEST SENS

SAT	REV	TIME	ELEV	AZMTH	RANGE	R-RATE	FAN	DIRECTION COSINES		
DAY	250	06/09/64			(KM)		NO.	U	V	W
00006	899	2045.68	1.9	121.9	2817	4.9	T	-.350	-.849	.397
00006	899	2046.00	1.0	123.8	2910	5.0	T	-.381	-.831	.406
00006	900	2221.88	42.1	284.7	1005	-1.8	T	.607	.718	.341
00006	900	2222.41	43.8	266.1	973	-.2	**	.455	.720	.524
00006	900	2223.37	38.7	234.4	1045	2.6	T	.121	.635	.763
00006	900	2224.51	27.3	212.2	1302	4.7	5	-.207	.474	.856
00006	900	2225.37	19.7	203.2	1570	5.5	T	-.374	.371	.850
00006	900	2227.37	7.3	192.6	2295	6.4	T	-.595	.216	.774
00006	900	2227.88	5.0	191.0	2492	6.4	W	-.630	.190	.753
00006	900	2228.86	1.0	188.6	2874	6.6	T	-.687	.150	.711

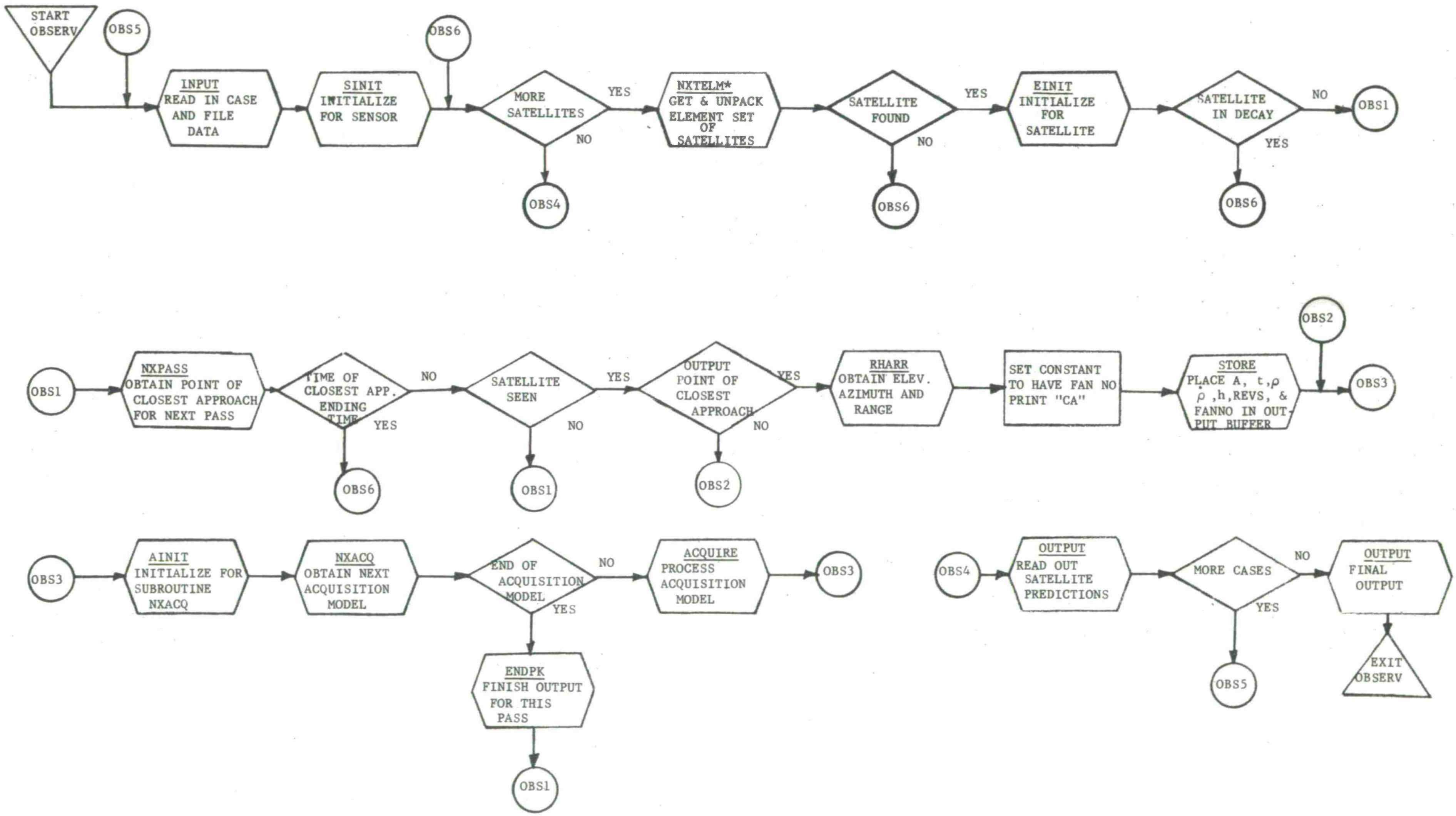
NO MORE DATA
BT

FIGURE 10 (13 of 13)

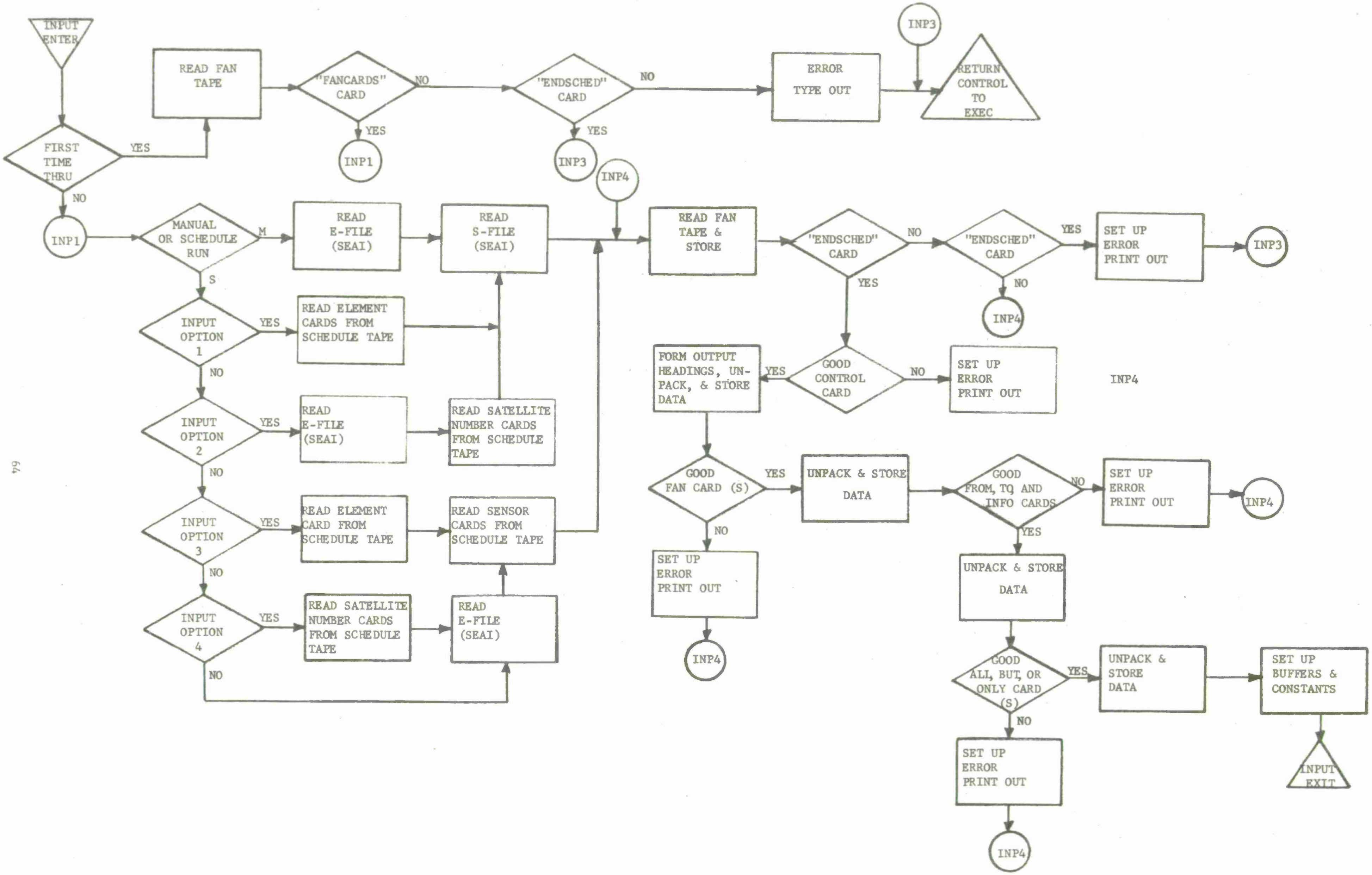
SECTION 6

FLOW DIAGRAMS

The following flow diagram displays the logical flow and computational procedures used in the program. Standard symbols are maintained throughout.

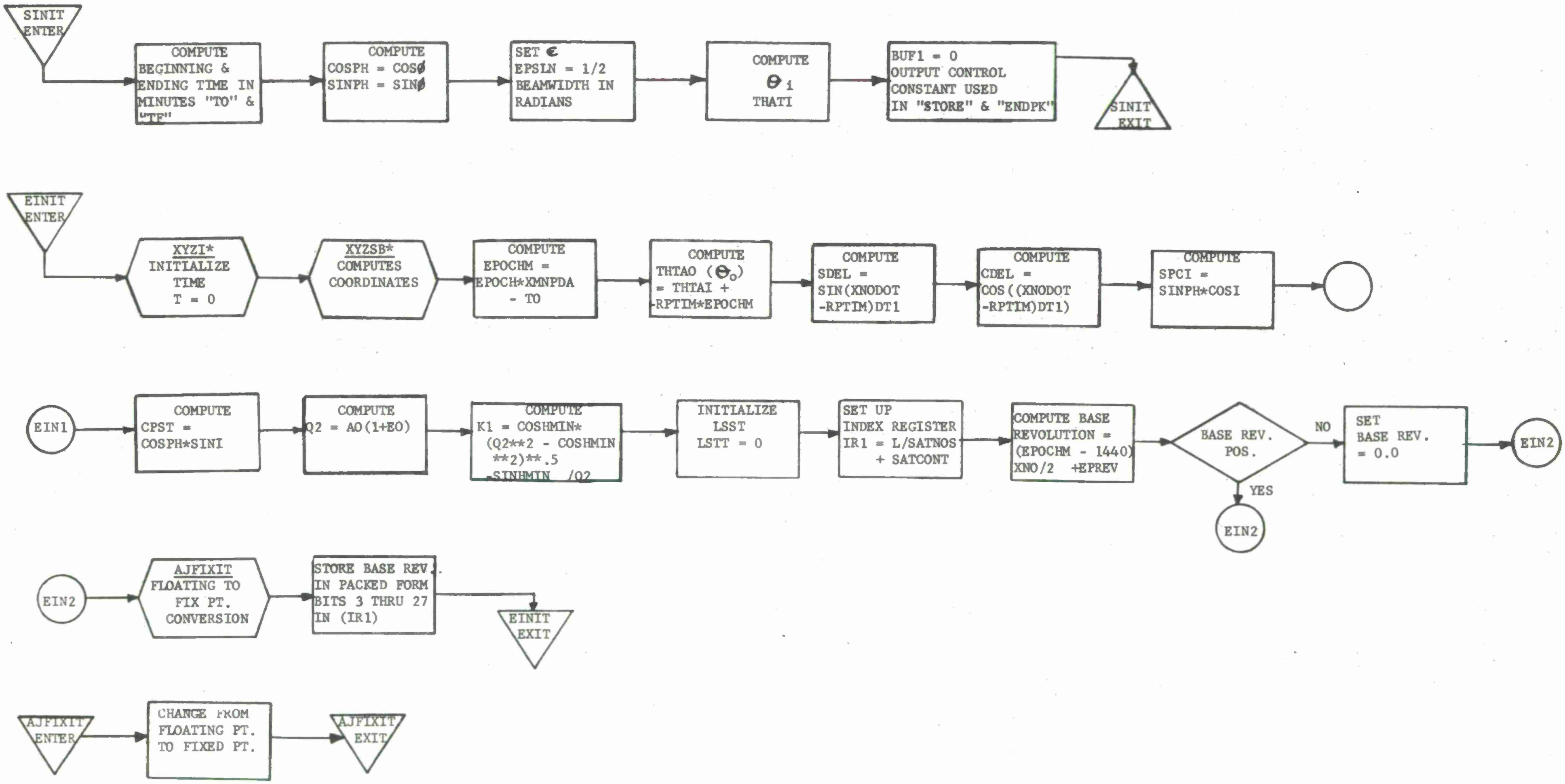


*B-2 SYSTEM SUBROUTINE

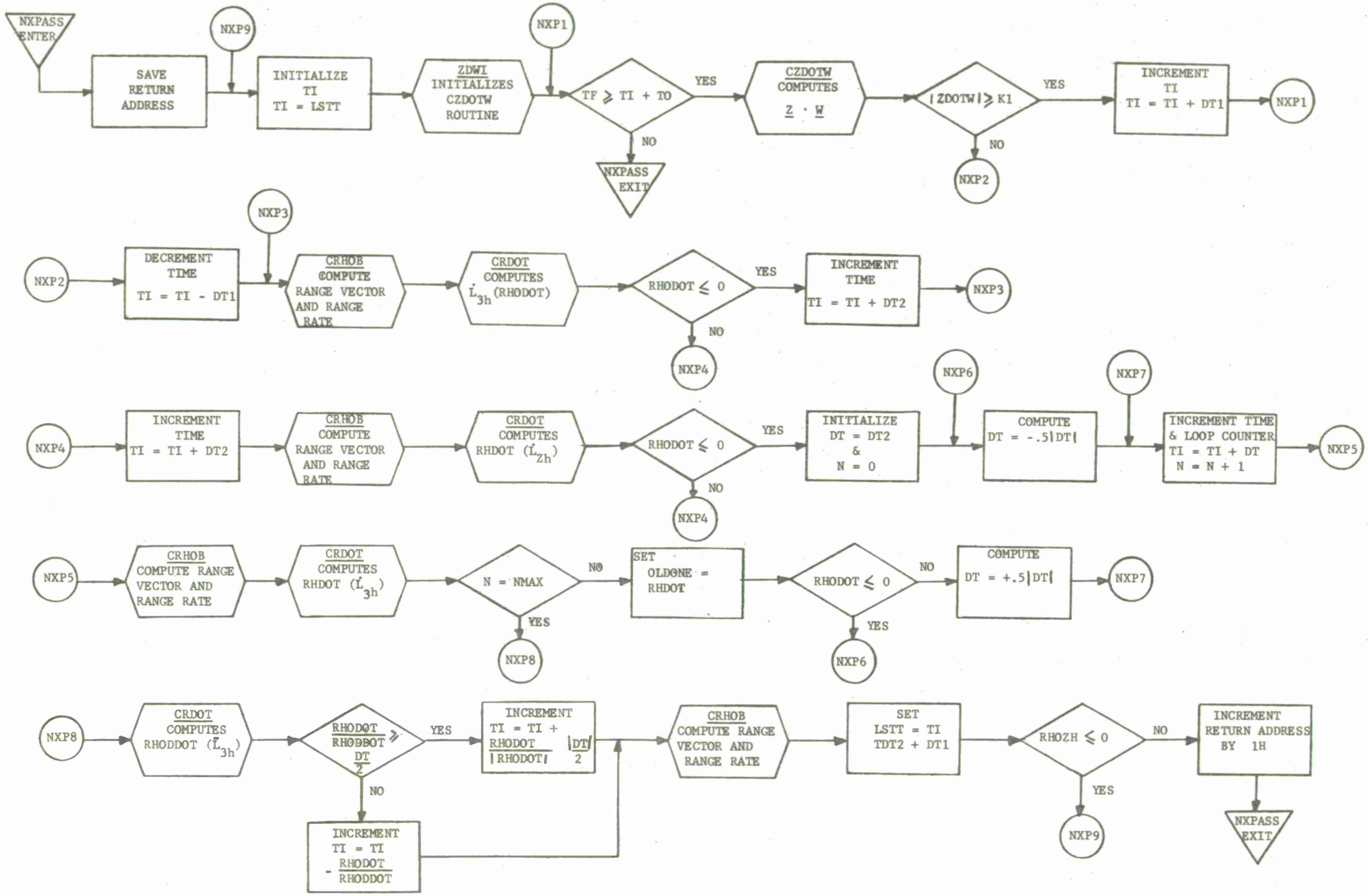


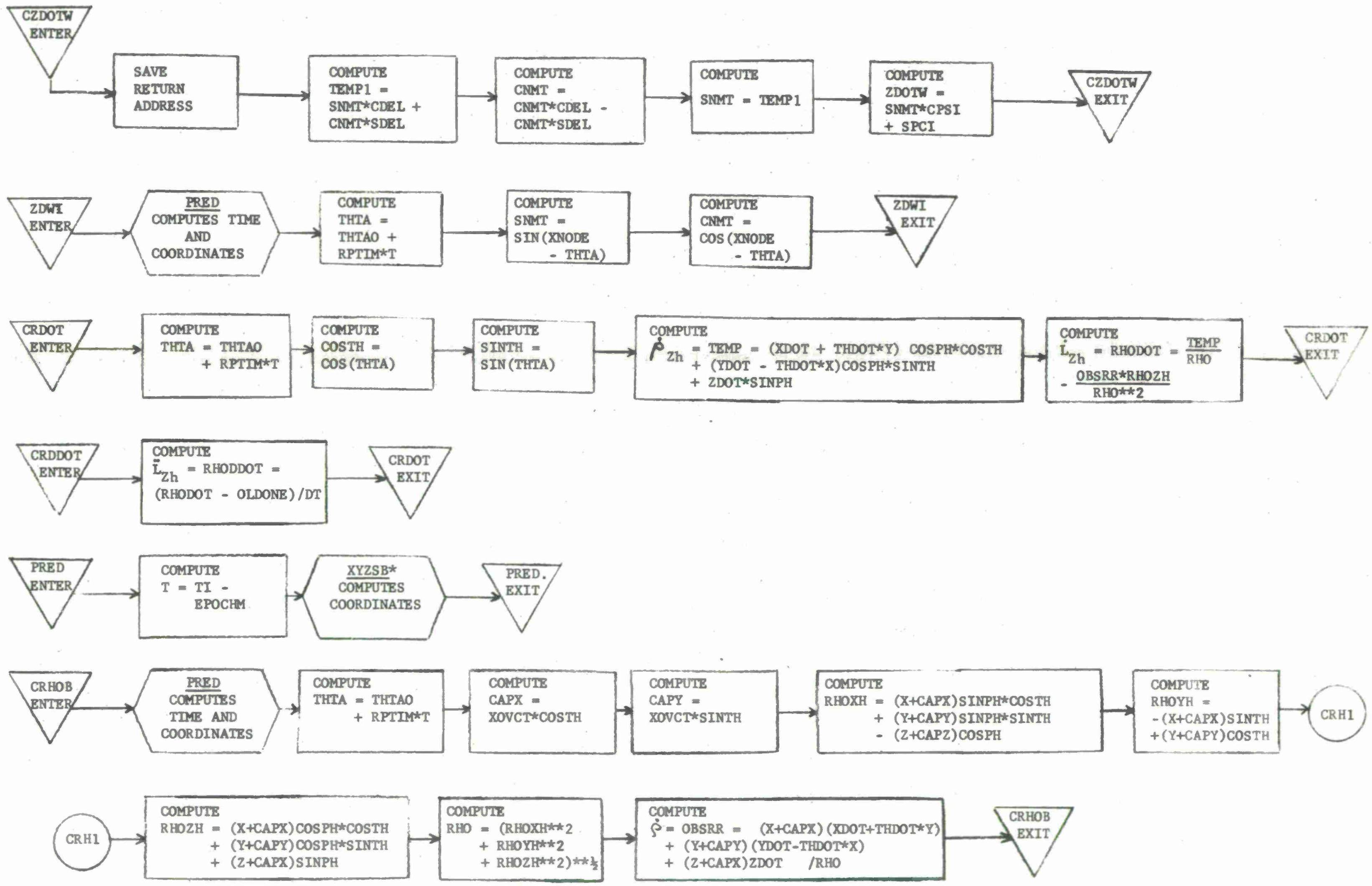
INPUT ENTER
FIRST TIME THRU
YES
NO
READ FAN TAPE
"FANCARDS" CARD
NO
YES
INP1
"ENDSCHED" CARD
NO
YES
INP3
ERROR TYPE OUT
INP3
RETURN CONTROL TO EXEC
INP4
INP1
MANUAL OR SCHEDULE RUN
M
S
READ E-FILE (SEAI)
READ S-FILE (SEAI)
READ FAN TAPE & STORE
"ENDSCHED" CARD
NO
YES
"ENDSCHED" CARD
YES
NO
INP4
SET UP ERROR PRINT OUT
INP3
INPUT OPTION 1
YES
NO
READ ELEMENT CARDS FROM SCHEDULE TAPE
INPUT OPTION 2
YES
NO
READ E-FILE (SEAI)
READ SATELLITE NUMBER CARDS FROM SCHEDULE TAPE
INPUT OPTION 3
YES
NO
READ ELEMENT CARD FROM SCHEDULE TAPE
READ SENSOR CARDS FROM SCHEDULE TAPE
INPUT OPTION 4
YES
NO
READ SATELLITE NUMBER CARDS FROM SCHEDULE TAPE
READ E-FILE (SEAI)
FORM OUTPUT HEADINGS, UN-PACK, & STORE DATA
YES
GOOD CONTROL CARD
NO
SET UP ERROR PRINT OUT
INP4
GOOD FAN CARD (S)
YES
NO
UNPACK & STORE DATA
GOOD FROM, TO, AND INFO CARDS
NO
YES
SET UP ERROR PRINT OUT
INP4
SET UP ERROR PRINT OUT
INP4
UNPACK & STORE DATA
GOOD ALL, BUT, OR ONLY CARD (S)
YES
NO
UNPACK & STORE DATA
SET UP BUFFERS & CONSTANTS
INPUT EXIT
SET UP ERROR PRINT OUT
INP4

64

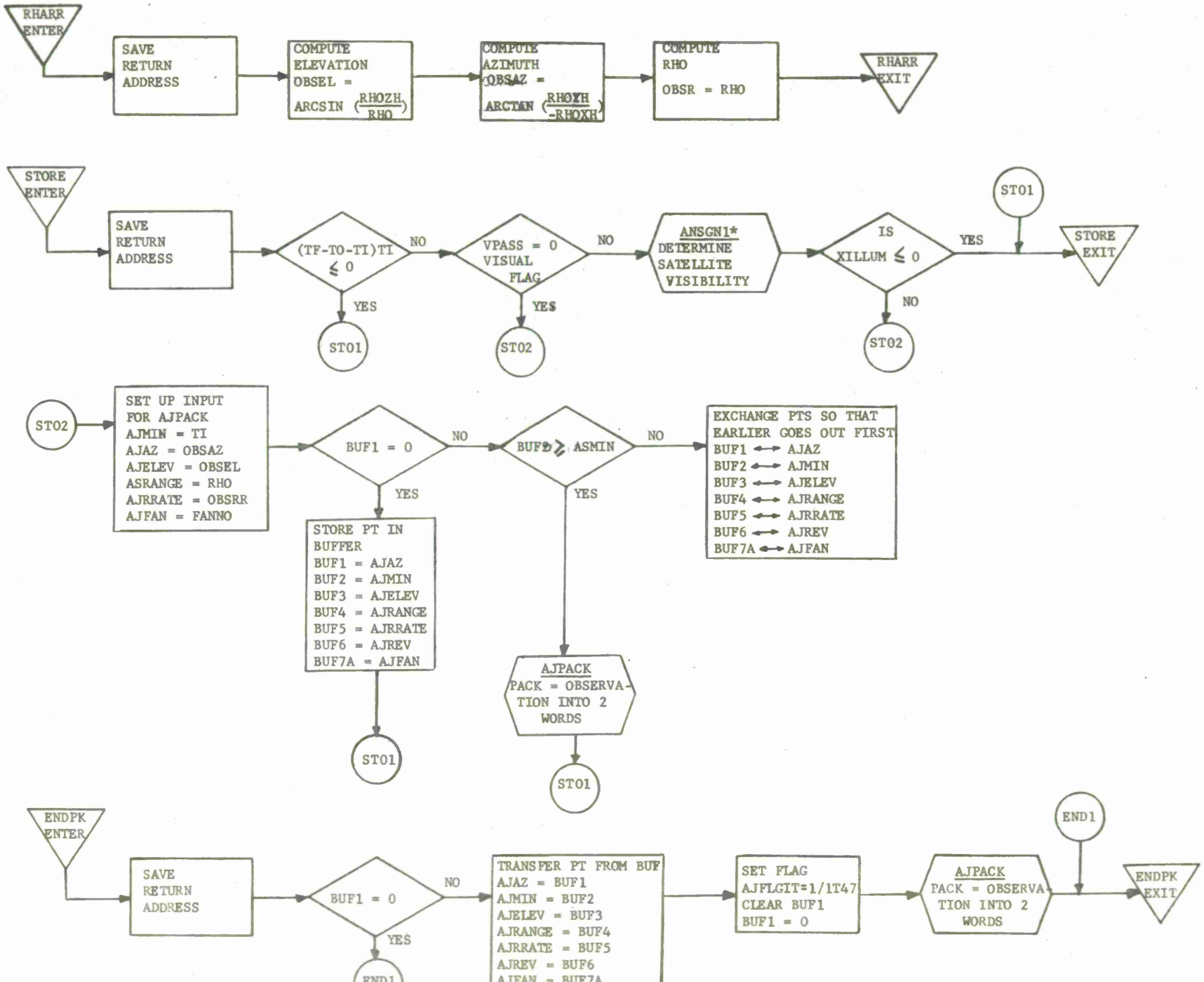


*B-2 System Subroutine

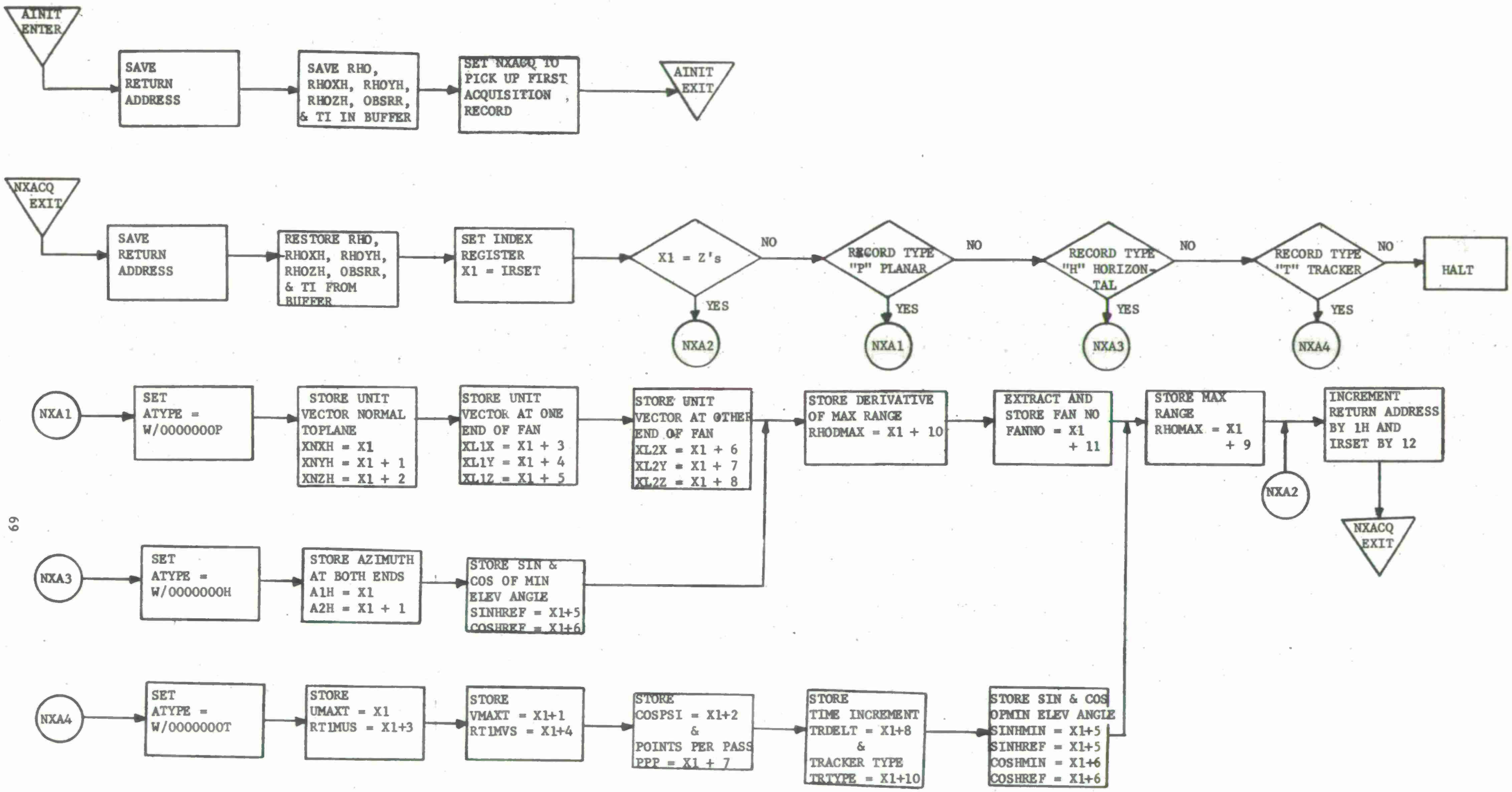

NXPASS ENTER
SAVE RETURN ADDRESS
NXP9
INITIALIZE TI
TI = LSTT
ZDWI INITIALIZES CZDOTW ROUTINE
NXP1
TF ≥ TI + TO
YES
NO
NXPASS EXIT
CZDOTW COMPUTES Z · W
\|ZDOTW\| ≥ K1
YES
NO
NXP2
INCREMENT TI
TI = TI + DT1
NXP1
NXP3
NXP2
DECREMENT TIME
TI = TI - DT1
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
CRDOT COMPUTES L̇3h (RHODOT)
RHODOT ≤ 0
YES
NO
NXP4
INCREMENT TIME
TI = TI + DT2
NXP3
NXP6
NXP7
NXP4
INCREMENT TIME
TI = TI + DT2
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
CRDOT COMPUTES RHDOT (L̇Zh)
RHODOT ≤ 0
YES
NO
NXP4
INITIALIZE DT = DT2 & N = 0
COMPUTE DT = -.5\|DT\|
INCREMENT TIME & LOOP COUNTER
TI = TI + DT
N = N + 1
NXP5
NXP5
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
CRDOT COMPUTES RHDOT (L̇3h)
N = NMAX
NO
YES
NXP8
SET OLDONE = RHDOT
RHODOT ≤ 0
NO
YES
NXP6
COMPUTE DT = +.5\|DT\|
NXP7
NXP8
CRDOT COMPUTES RHODDOT (L̈3h)
RHODOT / RHODDOT ≥ DT / 2
YES
NO
INCREMENT TI = TI + RHODOT / \|RHODOT\| · \|DT\| / 2
INCREMENT TI = TI - RHODOT / RHODDOT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
SET LSTT = TI
TDT2 + DT1
RHOZH ≤ 0
NO
YES
NXP9
INCREMENT RETURN ADDRESS BY 1H
NXPASS EXIT

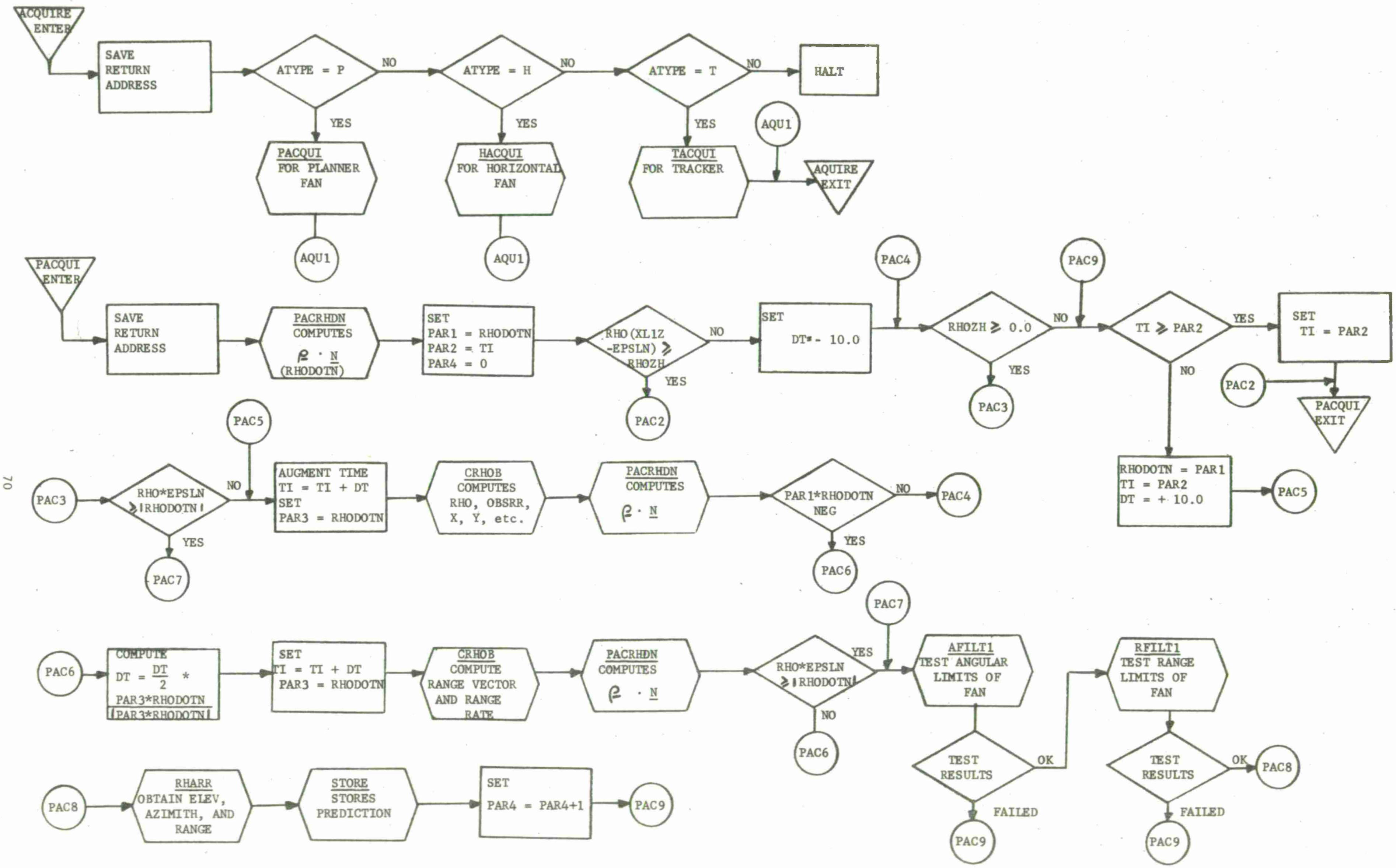


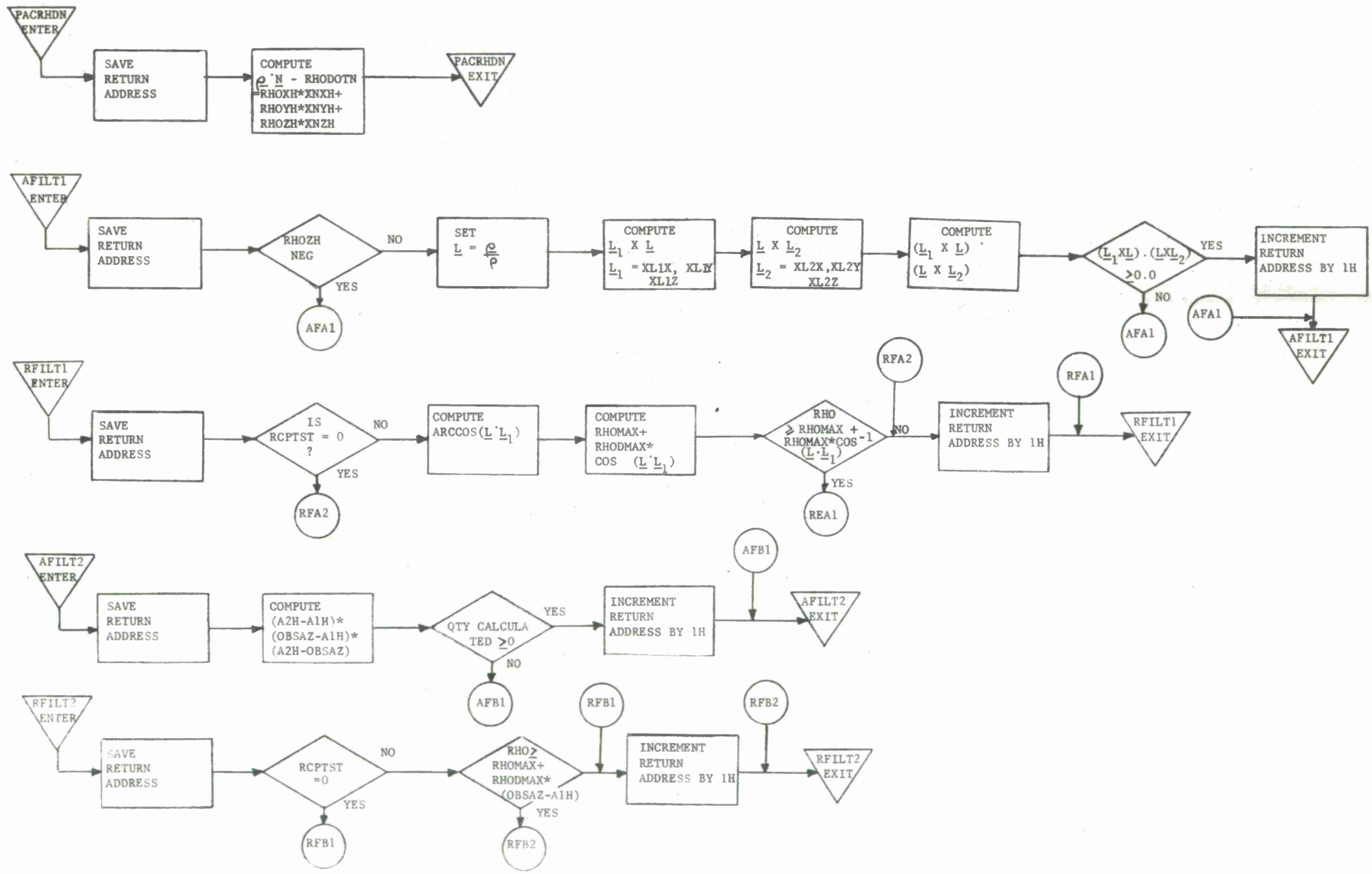
* B-2 System Subroutine



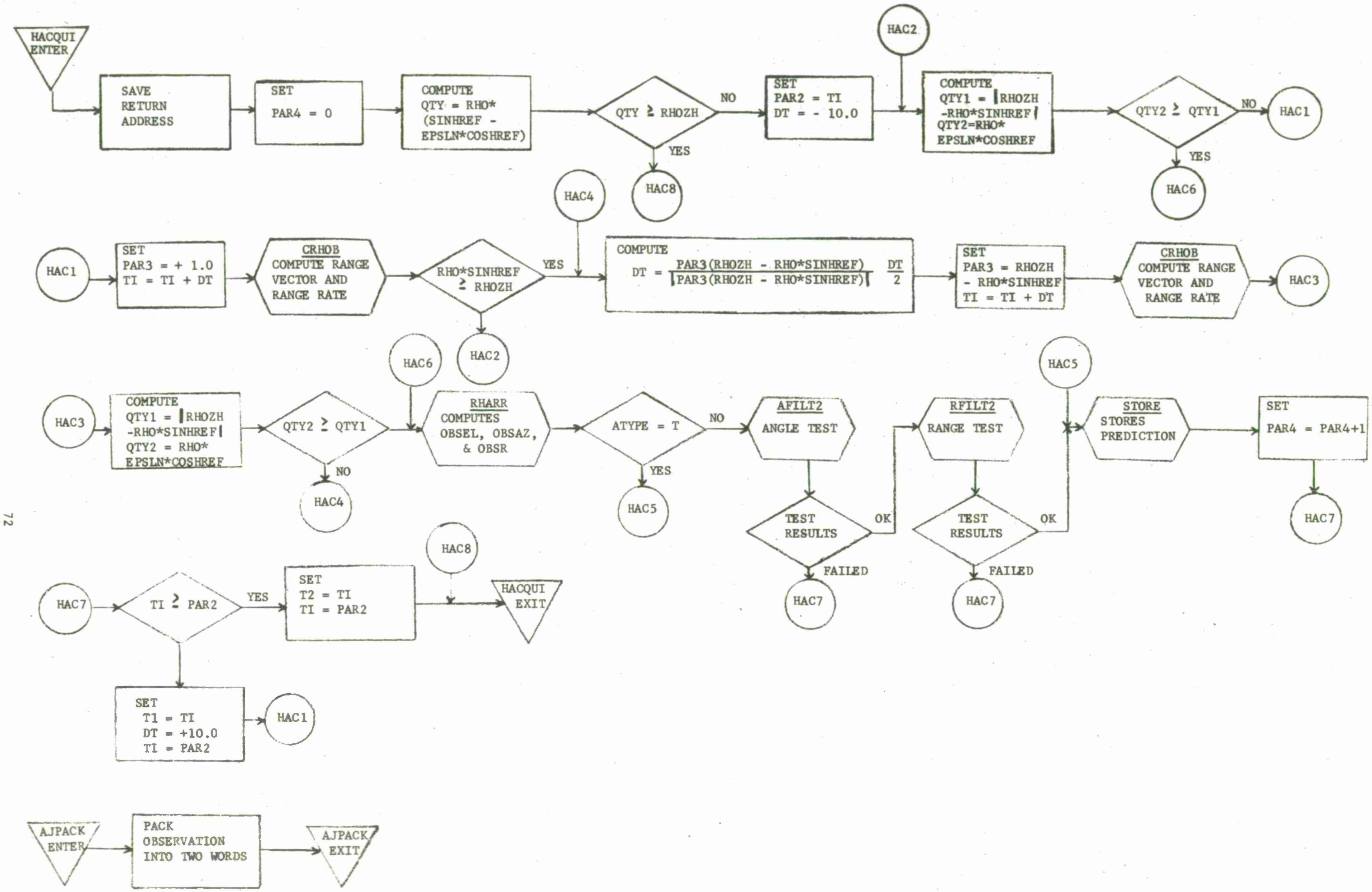
*B-2 System Subroutine

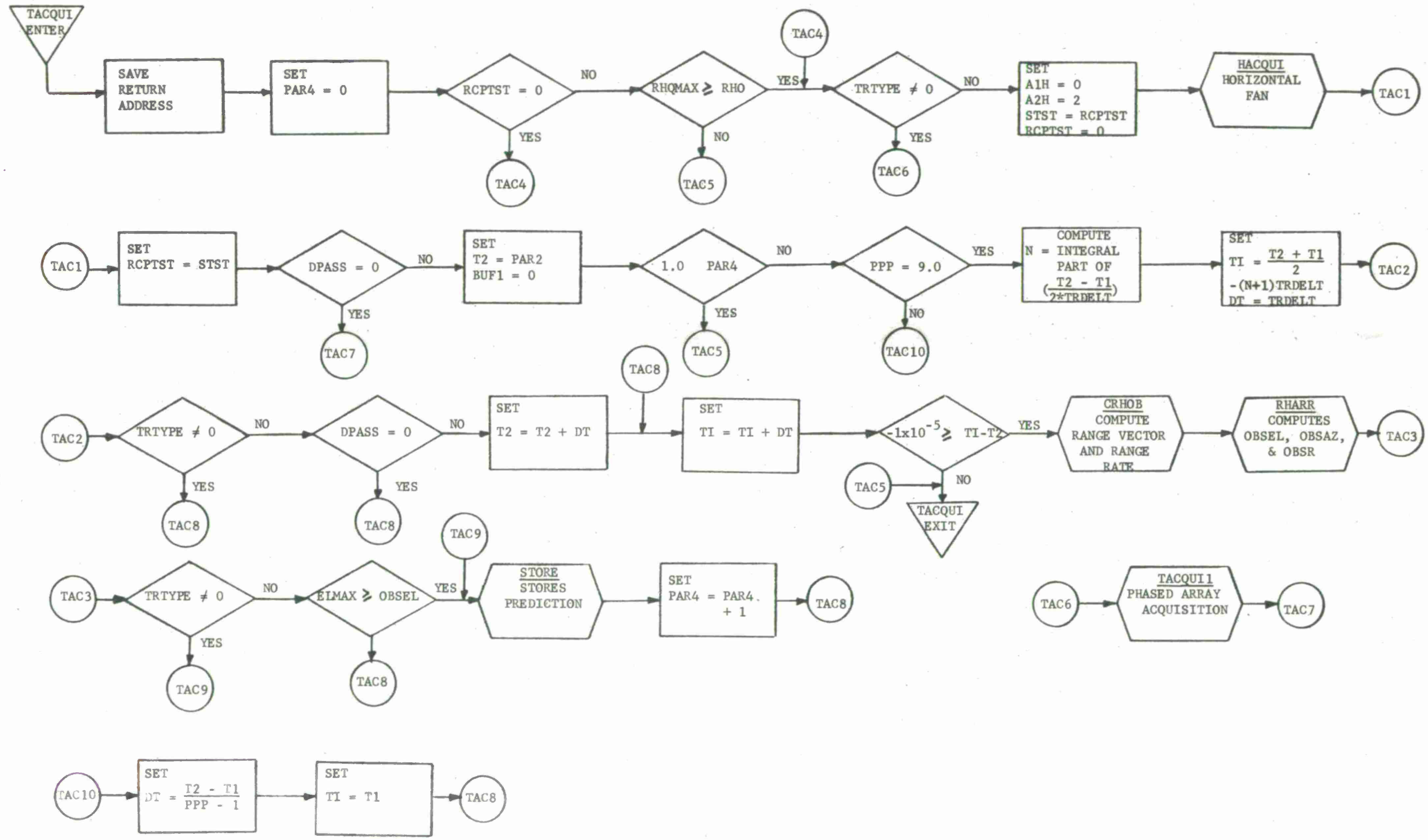

AINIT ENTER
SAVE RETURN ADDRESS
SAVE RHO, RHOXH, RHOYH, RHOZH, OBSRR, & TI IN BUFFER
SET NXACQ TO PICK UP FIRST ACQUISITION RECORD
AINIT EXIT
NXACQ EXIT
SAVE RETURN ADDRESS
RESTORE RHO, RHOXH, RHOYH, RHOZH, OBSRR, & TI FROM BUFFER
SET INDEX REGISTER X1 = IRSET
X1 = Z's
NO
YES
NXA2
RECORD TYPE "P" PLANAR
NXA1
RECORD TYPE "H" HORIZON-TAL
NXA3
RECORD TYPE "T" TRACKER
NXA4
HALT
NXA1
SET ATYPE = W/0000000P
STORE UNIT VECTOR NORMAL TOPLANE XNXH = X1 XNYH = X1 + 1 XNZH = X1 + 2
STORE UNIT VECTOR AT ONE END OF FAN XL1X = X1 + 3 XL1Y = X1 + 4 XL1Z = X1 + 5
STORE UNIT VECTOR AT OTHER END OF FAN XL2X = X1 + 6 XL2Y = X1 + 7 XL2Z = X1 + 8
STORE DERIVATIVE OF MAX RANGE RHODMAX = X1 + 10
EXTRACT AND STORE FAN NO FANNO = X1 + 11
STORE MAX RANGE RHOMAX = X1 + 9
NXA2
INCREMENT RETURN ADDRESS BY 1H AND IRSET BY 12
NXACQ EXIT
NXA3
SET ATYPE = W/0000000H
STORE AZIMUTH AT BOTH ENDS A1H = X1 A2H = X1 + 1
STORE SIN & COS OF MIN ELEV ANGLE SINHREF = X1+5 COSHREF = X1+6
NXA4
SET ATYPE = W/0000000T
STORE UMAXT = X1 RTIMUS = X1+3
STORE VMAXT = X1+1 RTIMVS = X1+4
STORE COSPSI = X1+2 & POINTS PER PASS PPP = X1 + 7
STORE TIME INCREMENT TRDELT = X1+8 & TRACKER TYPE TRTYPE = X1+10
STORE SIN & COS OPMIN ELEV ANGLE SINHMIN = X1+5 SINHREF = X1+5 COSHMIN = X1+6 COSHREF = X1+6


ACQUIRE ENTER
SAVE RETURN ADDRESS
ATYPE = P
NO
ATYPE = H
NO
ATYPE = T
NO
HALT
YES
PACQUI FOR PLANNER FAN
YES
HACQUI FOR HORIZONTAL FAN
YES
TACQUI FOR TRACKER
AQU1
AQUIRE EXIT
AQU1
AQU1
PACQUI ENTER
SAVE RETURN ADDRESS
PACRHDN COMPUTES ρ · N (RHODOTN)
SET PAR1 = RHODOTN PAR2 = TI PAR4 = 0
RHO(XL1Z -EPSLN) ≥ RHOZH
NO
YES
PAC2
SET DT = - 10.0
PAC4
RHOZH ≥ 0.0
NO
YES
PAC3
PAC9
TI ≥ PAR2
YES
NO
SET TI = PAR2
PAC2
PACQUI EXIT
RHODOTN = PAR1 TI = PAR2 DT = + 10.0
PAC5
PAC5
PAC3
RHO*EPSLN ≥ |RHODOTN|
NO
YES
PAC7
AUGMENT TIME TI = TI + DT SET PAR3 = RHODOTN
CRHOB COMPUTES RHO, OBSRR, X, Y, etc.
PACRHDN COMPUTES ρ · N
PAR1*RHODOTN NEG
NO
PAC4
YES
PAC6
PAC6
COMPUTE DT = DT/2 * PAR3*RHODOTN / |PAR3*RHODOTN|
SET TI = TI + DT PAR3 = RHODOTN
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
PACRHDN COMPUTES ρ · N
RHO*EPSLN ≥ |RHODOTN|
YES
NO
PAC6
PAC7
AFILT1 TEST ANGULAR LIMITS OF FAN
TEST RESULTS
OK
FAILED
PAC9
RFILT1 TEST RANGE LIMITS OF FAN
TEST RESULTS
OK
PAC8
FAILED
PAC9
PAC8
RHARR OBTAIN ELEV, AZIMITH, AND RANGE
STORE STORES PREDICTION
SET PAR4 = PAR4+1
PAC9

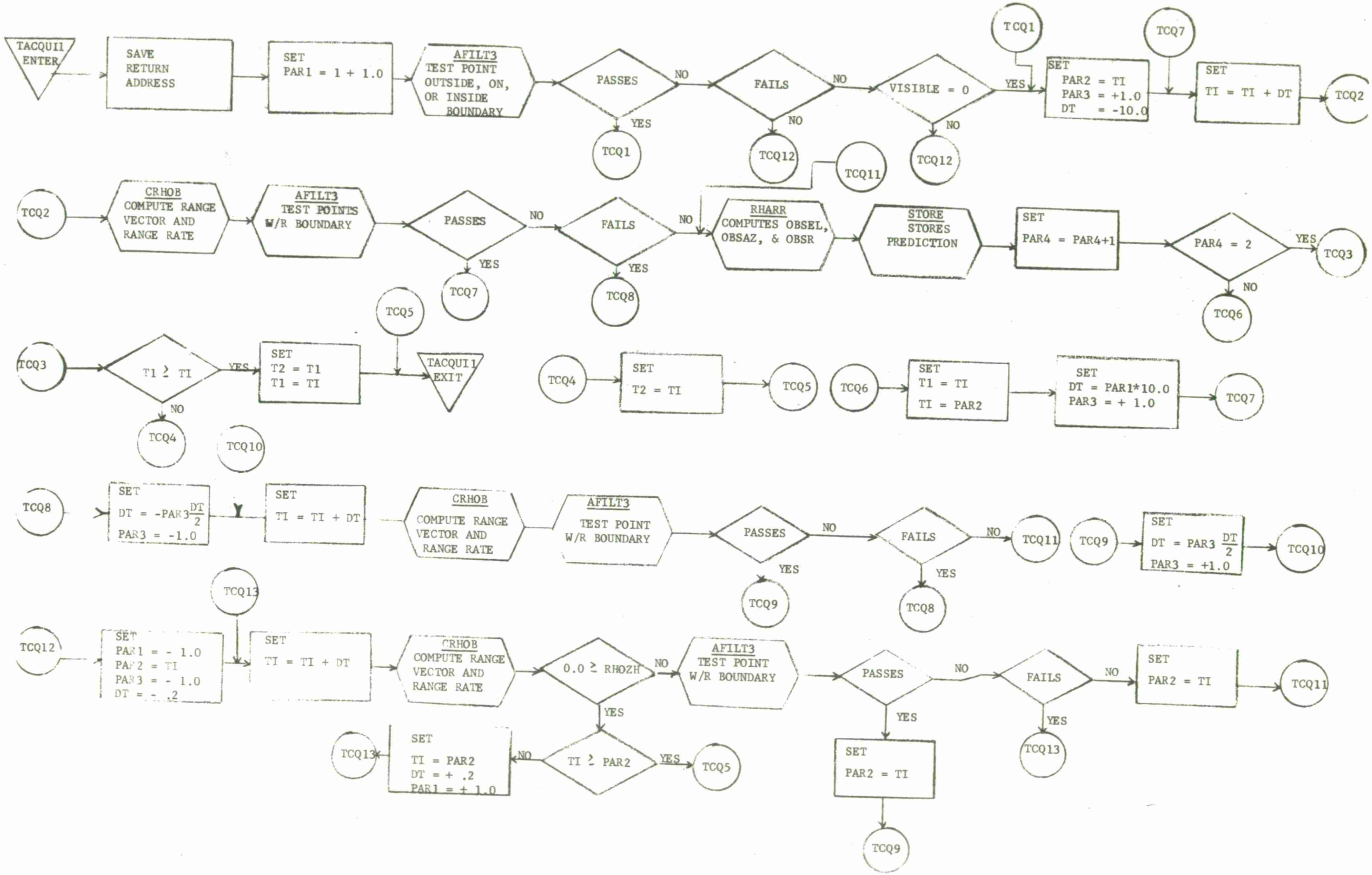


PACRHDN ENTER
SAVE RETURN ADDRESS
COMPUTE ρ·N - RHODOTN =RHOXH*XNXH+ RHOYH*XNYH+ RHOZH*XNZH
PACRHDN EXIT
AFILT1 ENTER
SAVE RETURN ADDRESS
RHOZH NEG
NO
YES
AFA1
SET L = ρ/ρ
COMPUTE L1 X L
L1 = XL1X, XL1Y XL1Z
COMPUTE L X L2
L2 = XL2X,XL2Y XL2Z
COMPUTE (L1 X L) · (L X L2)
(L1XL)·(LXL2) >0.0
YES
NO
AFA1
INCREMENT RETURN ADDRESS BY 1H
AFA1
AFILT1 EXIT
RFILT1 ENTER
SAVE RETURN ADDRESS
IS RCPTST = 0 ?
NO
YES
RFA2
COMPUTE ARCCOS(L·L1)
COMPUTE RHOMAX+ RHODMAX* COS (L·L1)
RFA2
RHO ≥ RHOMAX + RHOMAX*COS-1 (L·L1)
NO
YES
REA1
RFA1
INCREMENT RETURN ADDRESS BY 1H
RFILT1 EXIT
AFILT2 ENTER
SAVE RETURN ADDRESS
COMPUTE (A2H-A1H)* (OBSAZ-A1H)* (A2H-OBSAZ)
QTY CALCULA TED ≥0
YES
NO
AFB1
INCREMENT RETURN ADDRESS BY 1H
AFB1
AFILT2 EXIT
RFILT2 ENTER
SAVE RETURN ADDRESS
RCPTST =0
NO
YES
RFB1
RHO ≥ RHOMAX+ RHODMAX* (OBSAZ-A1H)
YES
RFB2
RFB1
INCREMENT RETURN ADDRESS BY 1H
RFB2
RFILT2 EXIT

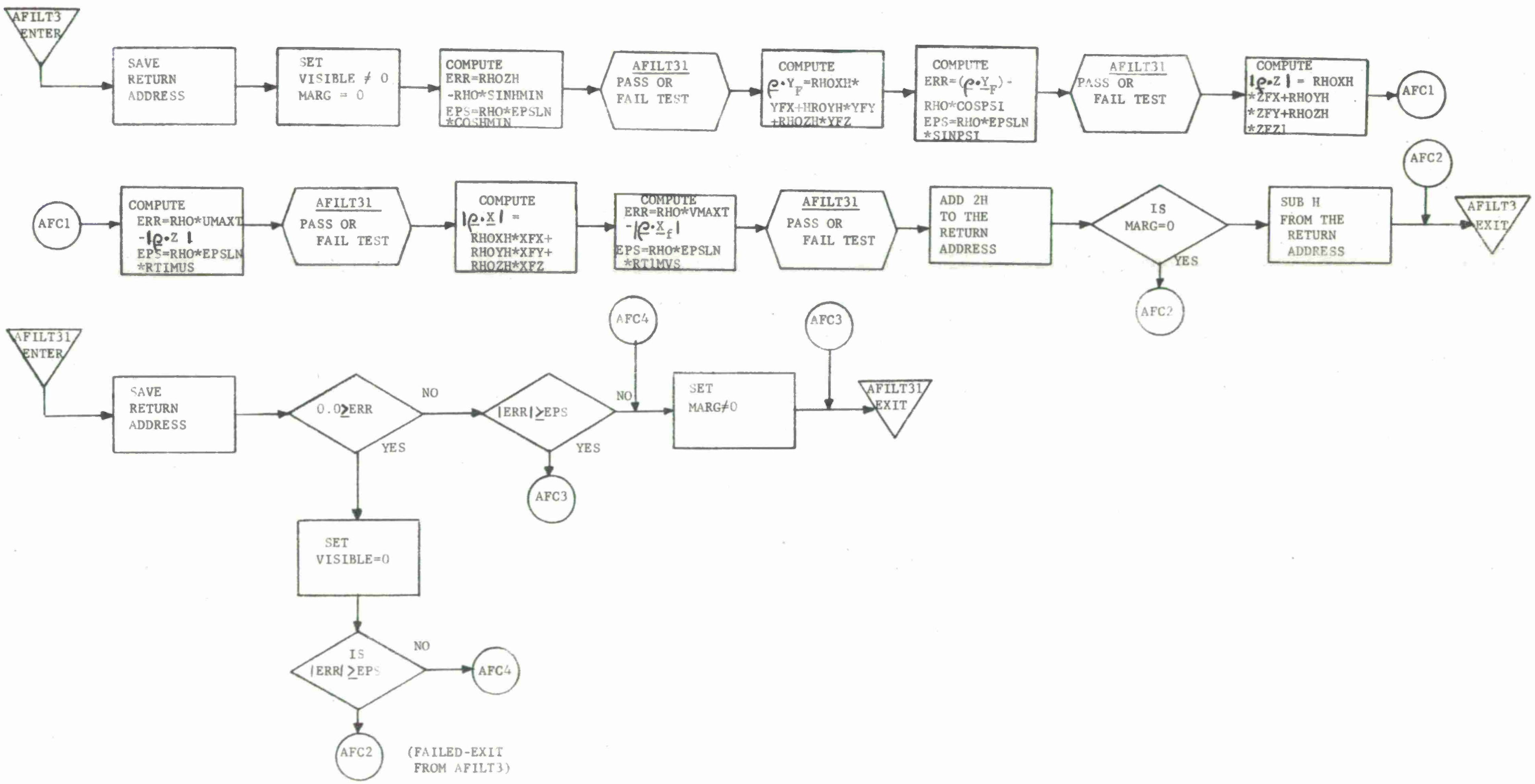

HACQUI ENTER
SAVE RETURN ADDRESS
SET PAR4 = 0
COMPUTE QTY = RHO* (SINHREF - EPSLN*COSHREF)
QTY ≥ RHOZH
NO
YES
HAC8
SET PAR2 = TI DT = - 10.0
HAC2
COMPUTE QTY1 = |RHOZH -RHO*SINHREF| QTY2=RHO* EPSLN*COSHREF
QTY2 ≥ QTY1
NO
HAC1
YES
HAC6
HAC1
SET PAR3 = + 1.0 TI = TI + DT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
RHO*SINHREF ≥ RHOZH
YES
HAC2
HAC4
COMPUTE DT = PAR3(RHOZH - RHO*SINHREF) / |PAR3(RHOZH - RHO*SINHREF)| DT/2
SET PAR3 = RHOZH - RHO*SINHREF TI = TI + DT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
HAC3
HAC3
COMPUTE QTY1 = |RHOZH -RHO*SINHREF| QTY2 = RHO* EPSLN*COSHREF
QTY2 ≥ QTY1
NO
HAC4
HAC6
RHARR COMPUTES OBSEL, OBSAZ, & OBSR
ATYPE = T
NO
YES
HAC5
AFILT2 ANGLE TEST
TEST RESULTS
OK
FAILED
HAC7
RFILT2 RANGE TEST
TEST RESULTS
OK
FAILED
HAC7
HAC5
STORE STORES PREDICTION
SET PAR4 = PAR4+1
HAC7
HAC7
TI ≥ PAR2
YES
SET T2 = TI TI = PAR2
HAC8
HACQUI EXIT
SET T1 = TI DT = +10.0 TI = PAR2
HAC1
AJPACK ENTER
PACK OBSERVATION INTO TWO WORDS
AJPACK EXIT



TACQUI ENTER
SAVE RETURN ADDRESS
SET PAR4 = 0
RCPTST = 0
NO
YES
TAC4
RHOMAX ≥ RHO
YES
NO
TAC5
TAC4
TRTYPE ≠ 0
NO
YES
TAC6
SET A1H = 0 A2H = 2 STST = RCPTST RCPTST = 0
HACQUI HORIZONTAL FAN
TAC1
TAC1
SET RCPTST = STST
DPASS = 0
NO
YES
TAC7
SET T2 = PAR2 BUF1 = 0
1.0 PAR4
NO
YES
TAC5
PPP = 9.0
YES
NO
TAC10
COMPUTE N = INTEGRAL PART OF (T2 - T1 / 2*TRDELT)
SET TI = T2 + T1 / 2 - (N+1)TRDELT DT = TRDELT
TAC2
TAC2
TRTYPE ≠ 0
NO
YES
TAC8
DPASS = 0
NO
YES
TAC8
SET T2 = T2 + DT
TAC8
SET TI = TI + DT
-1x10^-5 ≥ TI-T2
YES
NO
TAC5
TACQUI EXIT
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
RHARR COMPUTES OBSEL, OBSAZ, & OBSR
TAC3
TAC3
TRTYPE ≠ 0
NO
YES
TAC9
ELMAX ≥ OBSEL
YES
TAC8
TAC9
STORE STORES PREDICTION
SET PAR4 = PAR4 + 1
TAC8
TAC6
TACQUI1 PHASED ARRAY ACQUISITION
TAC7
TAC10
SET DT = T2 - T1 / PPP - 1
SET TI = T1
TAC8



TACQUI1 ENTER
SAVE RETURN ADDRESS
SET PAR1 = 1 + 1.0
AFILT3 TEST POINT OUTSIDE, ON, OR INSIDE BOUNDARY
PASSES
YES
NO
TCQ1
FAILS
TCQ12
VISIBLE = 0
TCQ7
SET PAR2 = TI PAR3 = +1.0 DT = -10.0
SET TI = TI + DT
TCQ2
CRHOB COMPUTE RANGE VECTOR AND RANGE RATE
AFILT3 TEST POINTS W/R BOUNDARY
TCQ8
TCQ11
RHARR COMPUTES OBSEL, OBSAZ, & OBSR
STORE STORES PREDICTION
SET PAR4 = PAR4+1
PAR4 = 2
TCQ3
TCQ6
TCQ5
T1 ≥ TI
SET T2 = T1 T1 = TI
TACQUI1 EXIT
TCQ4
SET T2 = TI
SET T1 = TI TI = PAR2
SET DT = PAR1*10.0 PAR3 = + 1.0
TCQ10
SET DT = -PAR3 DT/2 PAR3 = -1.0
SET TI = TI + DT
AFILT3 TEST POINT W/R BOUNDARY
TCQ9
SET DT = PAR3 DT/2 PAR3 = +1.0
TCQ13
SET PAR1 = - 1.0 PAR2 = TI PAR3 = - 1.0 DT = - .2
0.0 ≥ RHOZH
TI ≥ PAR2
SET TI = PAR2 DT = + .2 PAR1 = + 1.0
SET PAR2 = TI



AFILT3 ENTER
SAVE RETURN ADDRESS
SET VISIBLE ≠ 0 MARG = 0
COMPUTE ERR=RHOZH -RHO*SINHMIN EPS=RHO*EPSLN *COSHMIN
AFILT31 PASS OR FAIL TEST
COMPUTE ρ•Y_F=RHOXH* YFX+HROYH*YFY +RHOZH*YFZ
COMPUTE ERR=(ρ•Y_F)- RHO*COSPSI EPS=RHO*EPSLN *SINPSI
AFILT31 PASS OR FAIL TEST
COMPUTE |ρ•Z| = RHOXH *ZFX+RHOYH *ZFY+RHOZH *ZFZ1
AFC1
AFC2
AFC1
COMPUTE ERR=RHO*UMAXT -|ρ•Z| EPS=RHO*EPSLN *RTIMUS
AFILT31 PASS OR FAIL TEST
COMPUTE |ρ•X| = RHOXH*XFX+ RHOYH*XFY+ RHOZH*XFZ
COMPUTE ERR=RHO*VMAXT -|ρ•X_f| EPS=RHO*EPSLN *RTIMVS
AFILT31 PASS OR FAIL TEST
ADD 2H TO THE RETURN ADDRESS
IS MARG=0
YES
AFC2
SUB H FROM THE RETURN ADDRESS
AFILT3 EXIT
AFILT31 ENTER
SAVE RETURN ADDRESS
0.0≥ERR
NO
YES
|ERR|≥EPS
NO
YES
AFC3
AFC4
AFC3
SET MARG≠0
AFILT31 EXIT
SET VISIBLE=0
IS |ERR|≥EPS
NO
AFC4
AFC2
(FAILED-EXIT FROM AFILT3)

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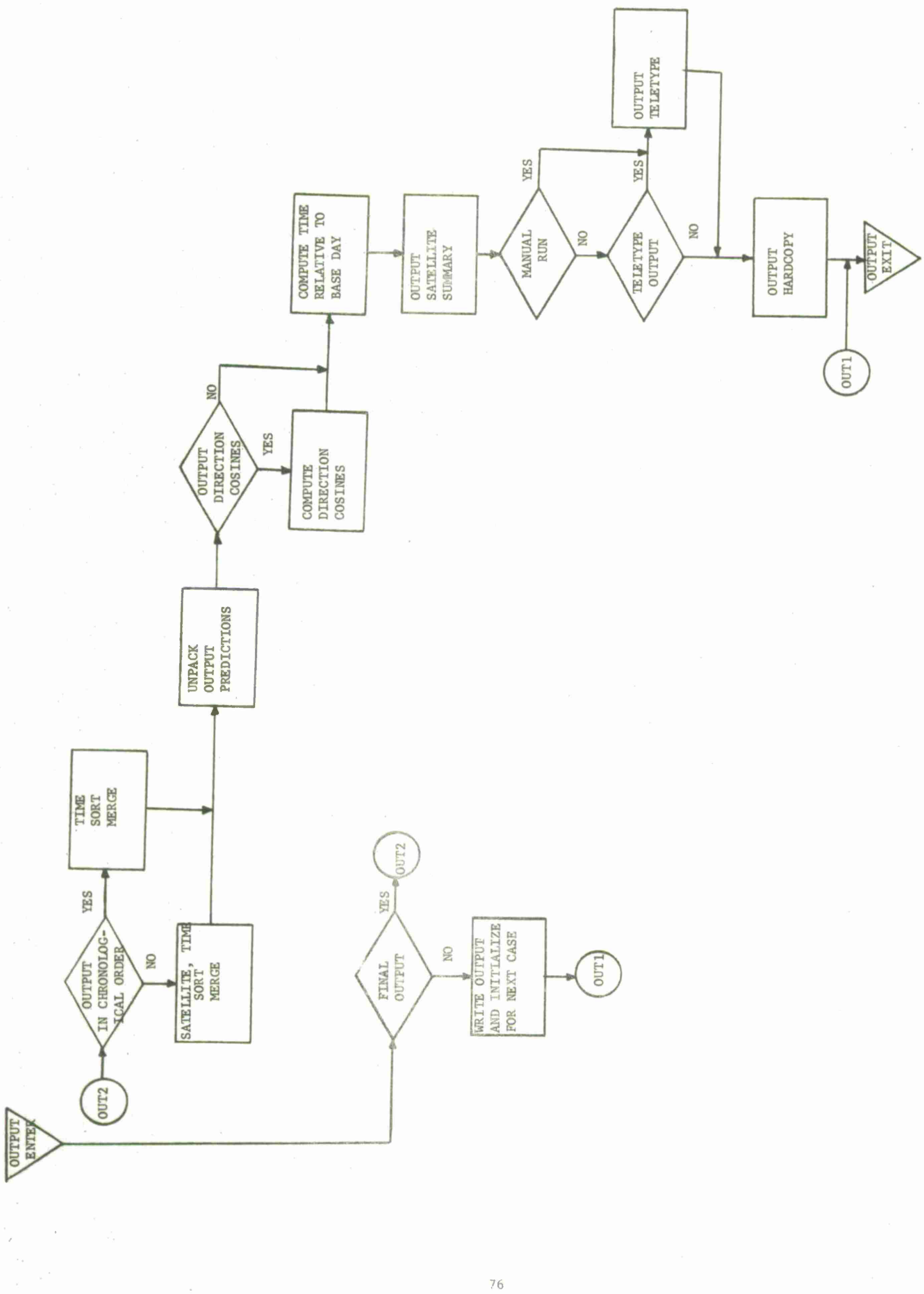


OUTPUT ENTER
OUT2
OUTPUT IN CHRONOLOG-ICAL ORDER
YES
NO
TIME SORT MERGE
SATELLITE, TIME SORT MERGE
UNPACK OUTPUT PREDICTIONS
OUTPUT DIRECTION COSINES
YES
NO
COMPUTE DIRECTION COSINES
COMPUTE TIME RELATIVE TO BASE DAY
OUTPUT SATELLITE SUMMARY
MANUAL RUN
YES
NO
TELETYPE OUTPUT
YES
NO
OUTPUT TELETYPE
OUTPUT HARDCOPY
OUTPUT EXIT
OUT1
FINAL OUTPUT
YES
NO
OUT2
WRITE OUTPUT AND INITIALIZE FOR NEXT CASE
OUT1

APPENDIX I

FILE FORMATS

Word			
1	48 bit floating point	XNX	
2	48 bit floating point	XNY	Unit vector normal to plane
3	48 bit floating point	XNZ	
4	48 bit floating point	XL1X	
5	48 bit floating point	XL1Y	Unit vector at one end of fan
6	48 bit floating point	XL1Z	
7	48 bit floating point	XL2X	
8	48 bit floating point	XL2Y	Unit vector at other end of fan (note: XL1Z $\leq$ XL2Z)
9	48 bit floating point	XL2Z	
10	48 bit floating point	RHOMAX - Maximum range at first end of fan	
11	48 bit floating point	RHODMAX - Derivative of maximum range	
12	N △ △ △ △ △ △ P	N - Fan Number (BCD); P - identification	

a. FANTAB - Planar Fan

FIGURE I-1. FORMAT FOR ACQUISITION BUFFER

Word			
1	48 bit floating point	A1H	Azimuth (coverage goes from A1H clockwise to A2H)
2	48 bit floating point	A2H	
3			
4			
5			
6	48 bit floating point	SINHREF	sine at constant elevation
7	48 bit floating point	COSHREF	cosine of constant elevation
8			
9			
10	48 bit floating point	RHOMAX - Maximum range at first end of fan	
11	48 bit floating point	RHODMAX - Derivative at maximum range	
12	N Δ Δ Δ Δ Δ Δ H	N - Fan Number (BCD) H - identification	

b. FANTAB - Horizontal Fan

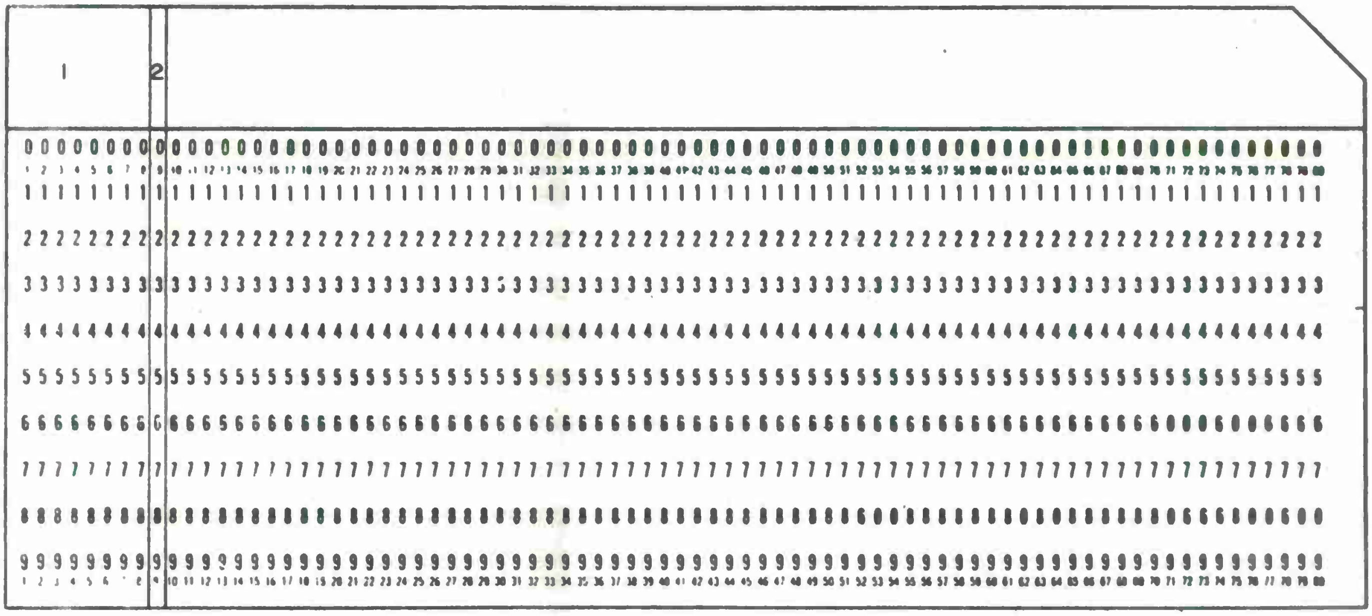
Word			
1	48 bit floating point	UMAXT	Not used for normal trackers
2	48 bit floating point	VMAXT	
3	48 bit floating point	COSPSI	
4	48 bit floating point	RT1MUS	
5	48 bit floating point	RT1MVS	
6	48 bit floating point	SINHMIN	sine of minimum elevation
7	48 bit floating point	COSHMIN	cosine of minimum elevation
8	48 bit floating point	PPP	points per pass
9	48 bit floating point	TRDELT	Δt (minutes)
10	48 bit floating point	RHOMAX	Maximum range
11	48 bit fixed point	TRTYPE	Tracker type 1 = Phased array 0 = normal
12	Δ Δ Δ Δ Δ Δ Δ T		T = identification

c. FANTAB - Tracker

FIGURE I-1. FORMAT FOR ACQUISITION BUFFER (continued)

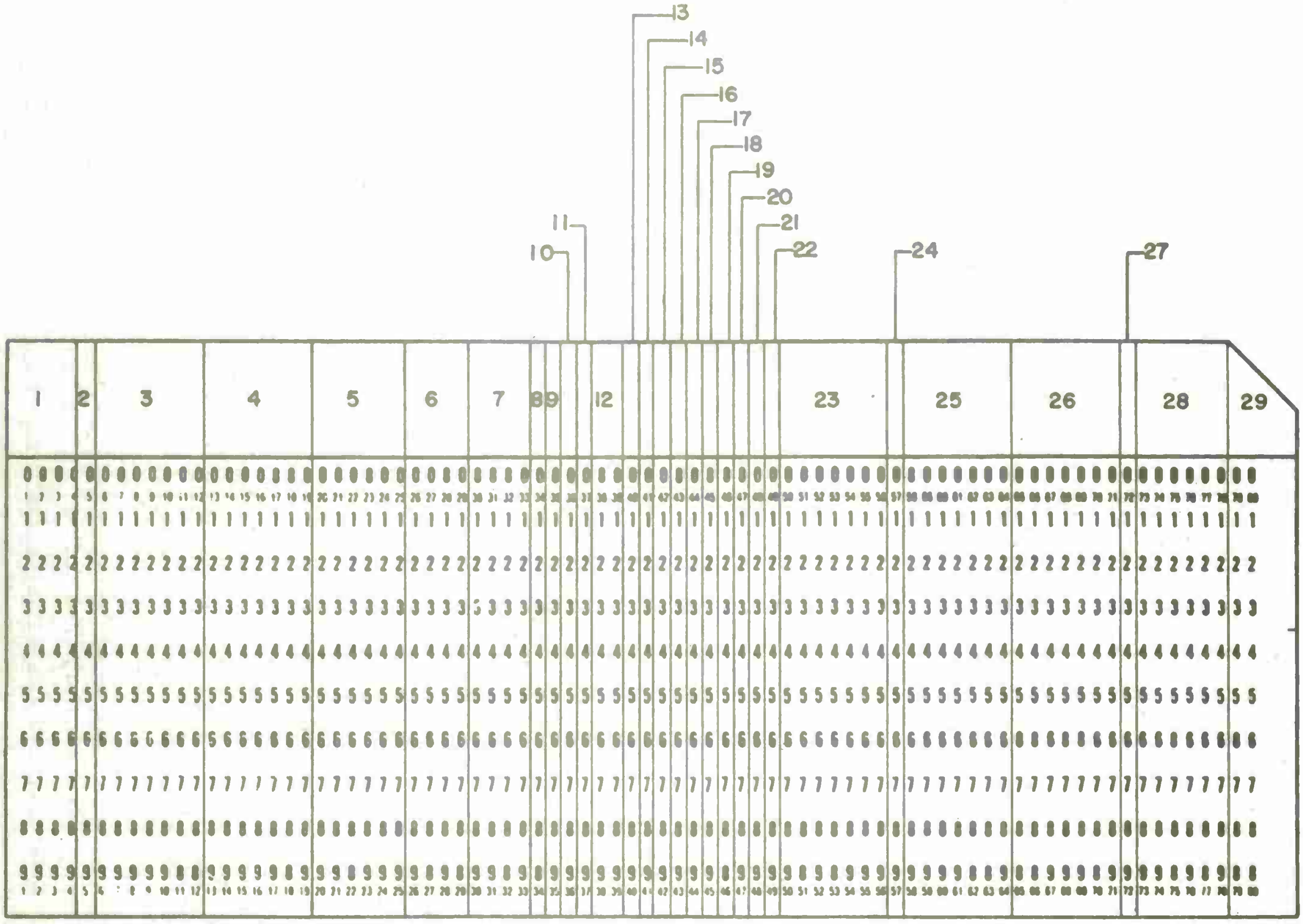
APPENDIX II

CARD FORMATS



Field	Column	Contents
1	1-8	"FANCARDS"
2	9	End of block character: 11-8-2 punch

FIGURE II-1. FAN INPUT DATA TAPE IDENTIFIER



Field	Column	Contents
1	1-4	Sensor number right adjusted
2	5	Not used
3	6-12	Beginning time - days since base time
4	13-19	End time - days since base time
5	20-25	Not used
6	26-29	Beamwidth - degrees
7	30-33	Year
8	34	Output indicator for fan number column on output. 0: No fan number 1: Fan number
9	35	Output indicator for units of range and range rate. 0: Nautical units 1: MKS Units

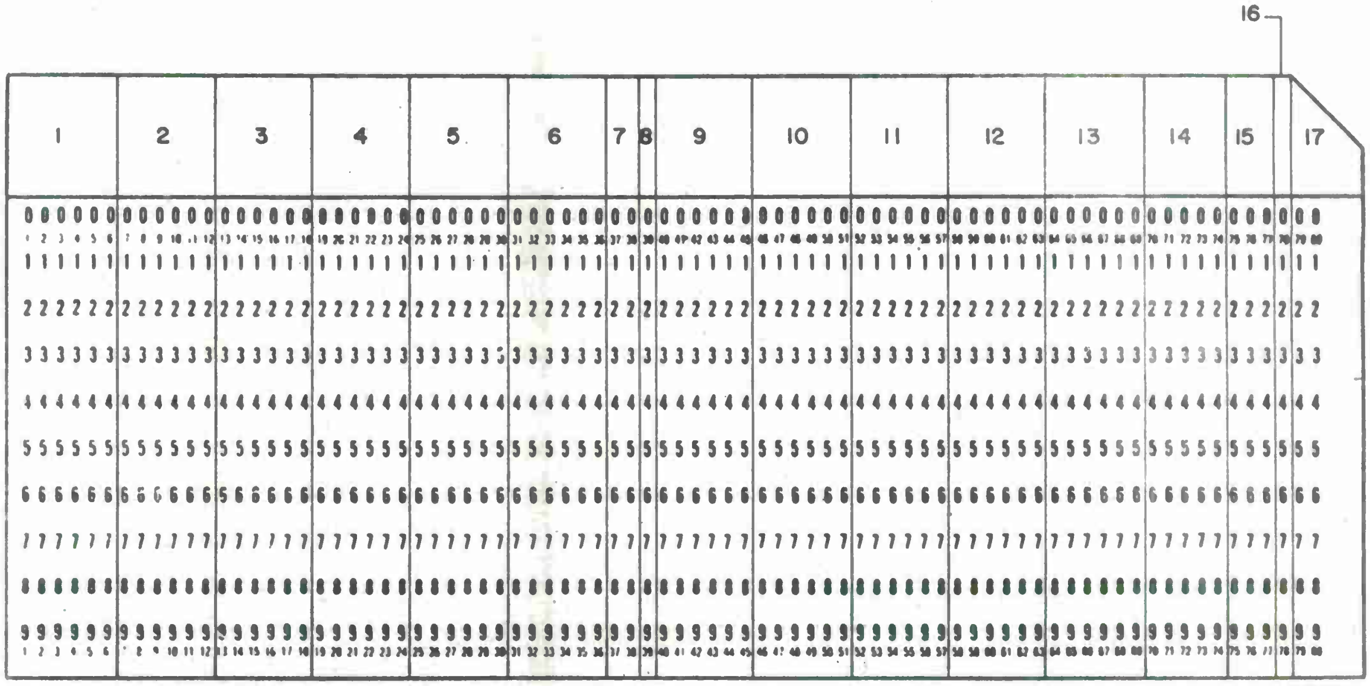
FIGURE II-2. CONTROL CARD

Field	Column	Contents
10	36	Not used
11	37	Classification indicator 0: Unclassified 1: Confidential 2: Secret 3: Secret/No form 4: Secret/Releasable outside SSO channels
12	38-39	Priority - printed on output message
13	40	Not used
14	41	Visual pass indicator 0: All passes 1: Visual passes only
15	42	Not used
16	43	Down pass indicator[1] 0: Complete pass computed 1: No points after closest point of approach
17	44	Not used
18	45	Point of maximum elevation 0: No 1: Yes
19	46	Not used
20	47	Maximum range test for point of closest approach 0: No test 1: Test
21	48	Not used
22	49	Interlace inhibit 0: Interlace predictions[2] 1: No mixture of predictions[3]
23	50-56	Not used
24	57	Direction cosines print out 0: No print out 1: Print out
25	58-64	Elevation angle of the boresight in degrees[4]
26	65-71	Boresight azimuth in degrees[4]
27	72	Element number option 0: Print revolution number 1: Print element number

1 For trackers only
2 Output in strictly chronological order
3 Same as (2) but satellite passes are not mixed
4 These fields are needed only if the tracker card indicates an FPS type tracker and/ or it is desired to print direction cosines

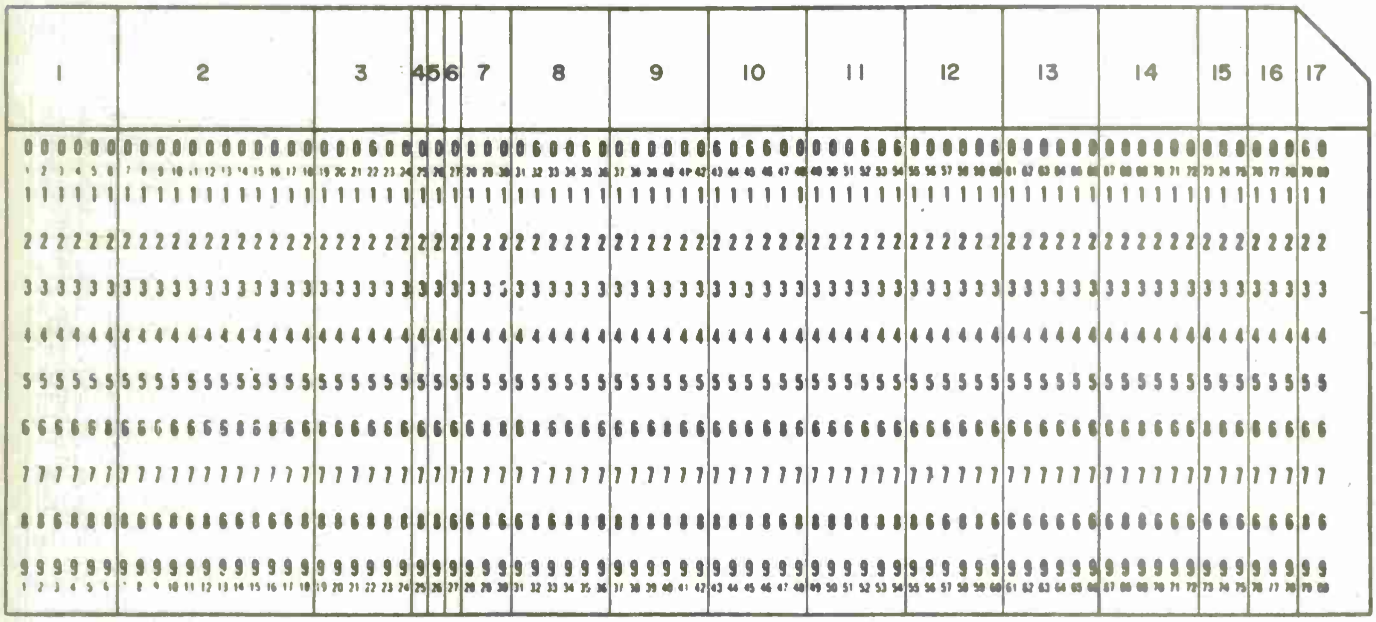
FIGURE II-2. CONTROL CARD (Continued)

Field	Column	Contents
28	73-78	Not used
29	79-80	"RP" - must contain these two letters as ID



Field	Column	Contents
1, 9	1-6, 40-45	Elevation angle at start of fan (h_1)-in degrees
2, 10	7-12, 46-51	Azimuth at start of fan (A_1) - in degrees
3, 11	13-18, 52-57	Maximum range at start of fan (ρ_{1max}) - in kilometers
4, 12	19-24, 58-63	Elevation angle at end of fan (h_2) - in degrees
5, 13	25-30, 64-69	Azimuth at end of fan (A_2) - in degrees
6, 14	31-36, 70-75	Maximum range at end of fan (ρ_{2max}) - in kilometers
7, 15	37-38, 76-77	Fan number (BCD)
8, 16	39, 78	Fan type "H" - Constant elevation azimuth scan "P" - Planar fan
17	79-80	"FP" - must contain these two letters as ID.

FIGURE II-3. FAN CARD

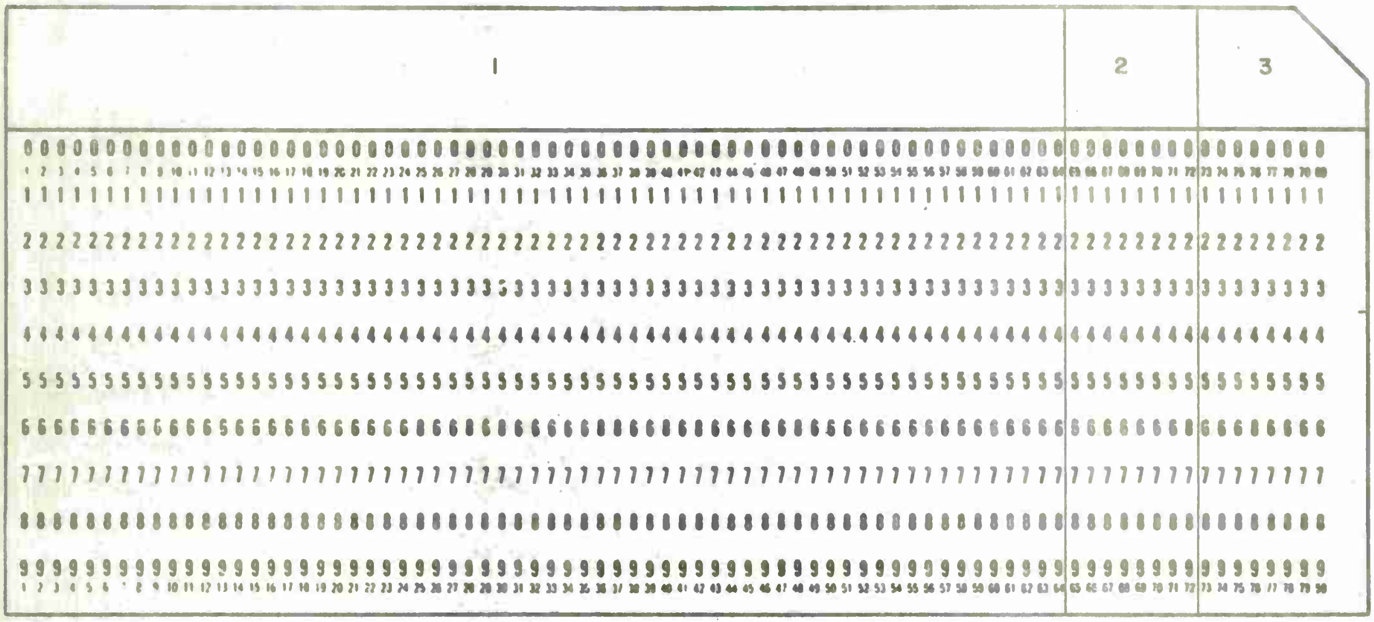


Field	Column	Contents
1	1-6	"Δ-99.0" An elevation of -99° signifies a request for acquisition coordinates for a tracking device
2	7-18	Not used
3	19-24	Minimum elevation - degrees - floating point
4	25	Points per pass 2-8: 2-8 points per pass 9: points every delta T (field 8)
5	26	Not used
6	27	Tracker type Δ or 0: Normal tracker 1: FPS-85 tracker
7	28-30	Not used
8	31-36	Time increment in minutes - (needed only if points per pass = 9)
9	37-42	Limiting value of the SIN of the boresight oriented angle α - sin α - floating point boresight oriented
10	43-48	Limiting value of the SIN of the angle β - sin β - floating point
11	49-54	Limiting value of the off-boresight angle, ψ, in degrees

FIGURE II-4. TRACKER CARD

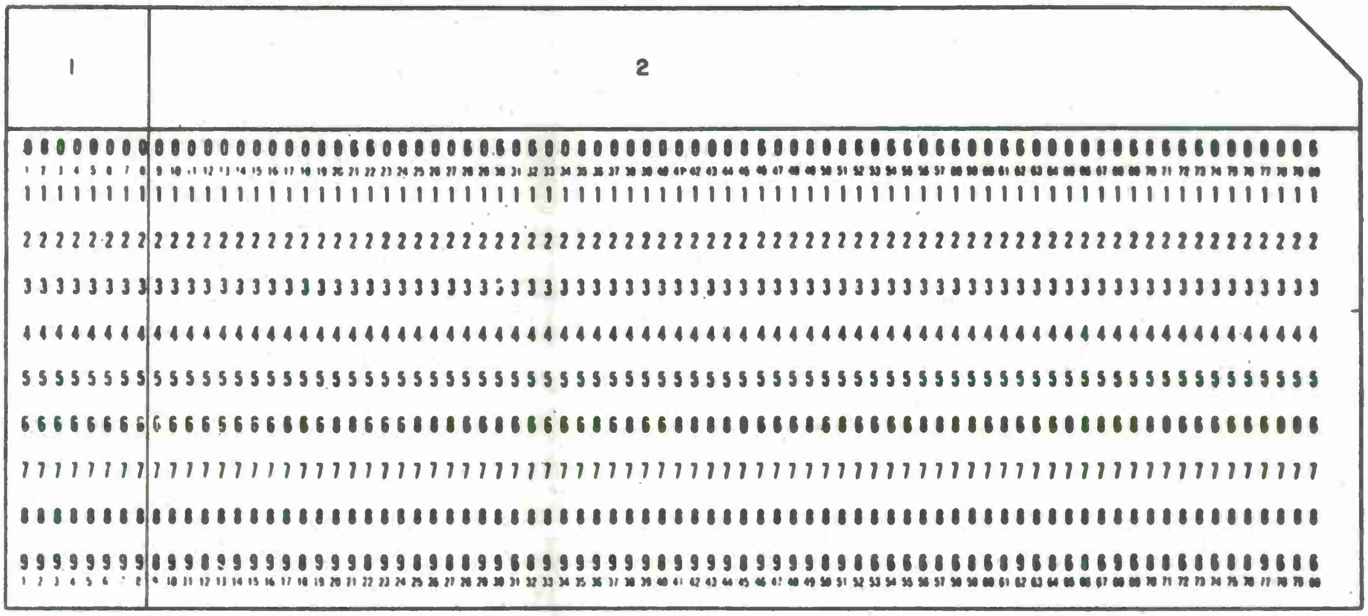
Field	Columns	Contents
12	55-60	Maximum observable range - floating point kilometers
13	61-66	Maximum elevation angle to be used for normal tracker only - if blank, 90° is assumed
14	67-72	Not used
15	73-75	Sensor number
16	76-78	Not used
17	79-80	"FP" - must contain these two letters as ID.

FIGURE II-4. TRACKER CARD (Continued)



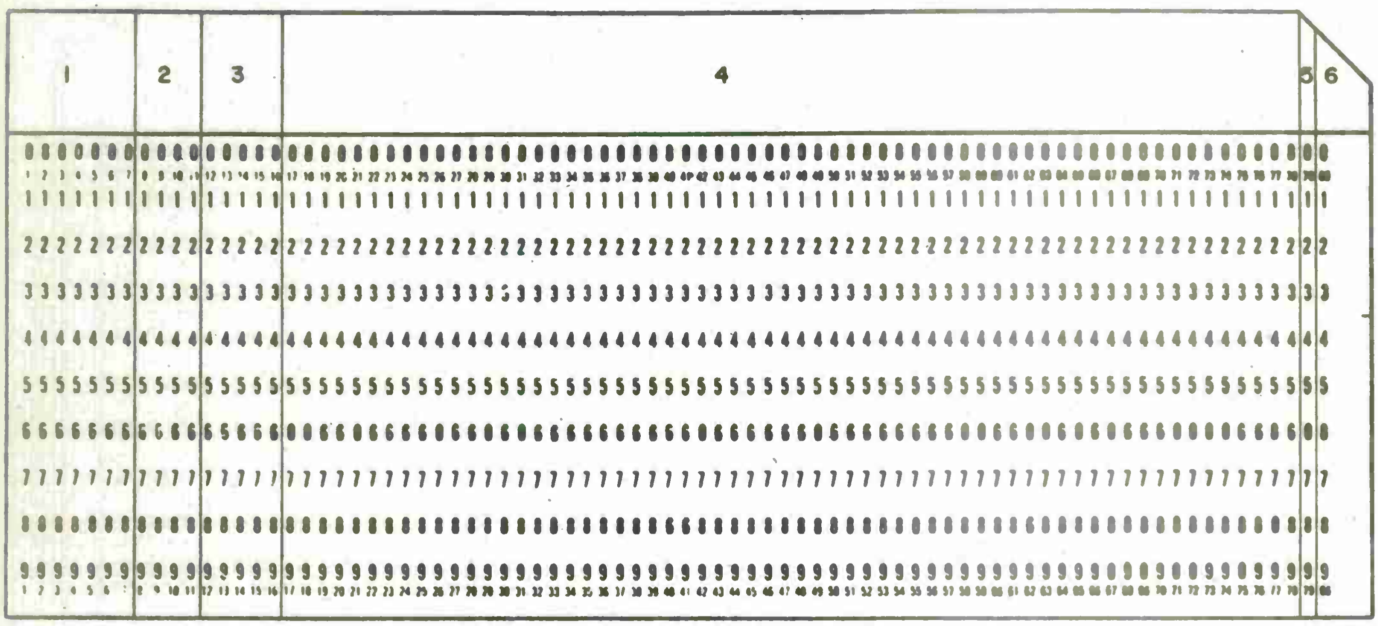
Field	Column	Contents
1	1-64	Station address - 64 BCD characters (can also include the routing address, even though this will be repeated in Columns 65-72)
2	65-72	Routing address - 6 or 7 BCD characters
3	73-80	Card identifier, one of the following: FROMXXXA, TO△△XXXA, or INFOXXXA; XXX is sensor number

FIGURE II-5. ADDRESS CARD



Field	Column	Contents
1	1-8	ALL ΔΔΔΔ ALLΔBUTΔ ONLY ΔΔΔΔ
2	9-80	1. Not used for ALL Cards 2. For "ALL BUT" and "ONLY" Cards - This field contains five -digit satellite identifiers, separated by commas and/or two five -digit satellite identifiers separated by a minus.

FIGURE II-6. ALL, ALL BUT, or ONLY CARD



Field	Column	Contents
1	1-7	Base Time - day number in year and fraction, decimal punched in Column 4
2	8-11	Not used
3	12-16	Message number, right adjusted
4	17-78	Not used
5	79	B
6	80	P

FIGURE II-7. BASE TIME CARD

```
         SET     39                $
         JMP     START             $
         SET     M/52500                     $

         SAME    ORIGIN,START                $
START    JMP     (P)+2                       $
         NOP                                 $
         HLT                                 $
         HLT                                 $
         TMD     W/FANCARDS                  $
           TDM   SYSNAME
           TMA   P/SYSTAB.T39
           JMP   TAPCK
           TMA   P/SYSTAB+7,T39
           JMP   TAPCK
           TMA   P/SYSTAB+8,T39
           JMP   TAPCK
           TMA   P/SYSTAB+9,T39
           JMP   TAPCK
             TMA N/11T15;P/SYSTAB,T39
           JMP   PANT.PINT
         CM      PHAIN                       $
         TMD     C/TJML,EREX;C/JMP,ER10     $
         TDM     0        $
         TDM     3        $
         TMD     C/HLTL,E8LOC$
         TDM     ILOCE$
         CM      NOELM$
         CM      AJDNCNT   $
         TMA     EXLOD                       $
         JAZ     (P)+2H                      $
         JMP     GO ON                       $
         TMD     1/1T6                       $
         TDM     CARDTYP                     $
         CM      NOTTY                       $
         TMD     W/         BP               $
         TDM     CONBUF+9                    $
TAG1     TMA     C/HLT,18;C/HLT,TAG6         $
         JMP     FLEX                        $
         TMQ     W/         0                $
TAG3     CD                                  $
         JMP     TCMR                        $
         TDA                                 $
         TMD     0/72T47                     $
         JAED    TAG1                        $
         TMD     0/32T47                     $
         JAED    TAG2                        $
         AQ                                  $
         SLA     6                           $
         TAQ                                 $
         JMP     TAG3                        $
TAG2     TQM     CONBUF                      $
         TMA     C/HLT,18;C/HLT,TAG7         $
         JMP     FLEX                        $
         TMQ     W/         0                $
TAG4     CD                                  $
         JMP     TCMR                        $
         TDA                                 $
         TMD     0/72T47                     $
```



```
         JAED    TAG2+1H                     $
         TMD     0/32T47                     $
         JAED    TAG5                        $
         AQ                                  $
         SLA     6                           $
         TAQ                                 $
         JMP     TAG4                        $
TAG5     SRQ     6                           $
         TQM     CONBUF+1                    $
         JMP     GO ON                       $
TAG6     0/32;A/BASE DA$                     $
         A/Y$                                $
         A/ ;0/52T11$                        $
TAG7     0/32;A/BASE ME$                     $
         A/SSAGE NO$                         $
         A/,;0/52T11$                        $
GO ON    TMD     L/CONBUF                    $
           TDXLC ,3
           TMA   9,3
           TMD   W/         BP
           JAED  (P)+2H
           JMP   CASE REJ
           TMA   0,3
           TMD   W/
           JAED  CASE REJ
           TMQ   0/0000001717171717
           ETA   1,3
         JAZ     CASEREJ
           TAM   AJMSGNO

L          TMA   (P)+2
           JMP   XSRCH
           JAZ   CASE REJ
           JMP   LOAD
           HLT
           TIJL  (P)+1H
           ICOZ  7+128+7
           CAM   BASE
         A/CASE REJECTED-BAS

         A/SE TIME CARD MISS

         A/SING OR IN ERRORS 48

CASEREJTMA       N/6T15;P/(P)-6,T39$
         JMP     PANT
         TMA     N/48T15;P/(P)-7,T39
         JMP     FLEX
         TMA     N/10T15;P/CONBUF,T39
         JMP     PANT
         JMP     PANT.FINISH
         JMP     MANEXIT                     $
L BUFA   SET     (P)+128$
  BUFB   SET     (P)+128$
  START6 TJM     READX$
```

```
         JMP     BUF022$
 RD6A    TJM     READX$
         TMD     TIO$
         TDXLC   0,3$
         TMD     C/HLT,0;C/HLT,SYSTAB$
         JMP     SYSIO$
         TMD     C/HLT,BUFA;C/HLT,BUF01$
         AIXJ    0,3$
 BUF022  TIJ     BUFB$
         TJM     TIO$

L READ   TMA     1/110010001T47$
R        JMP     SYS$
 TIO     TIO     $
         JMP     SYSNO$
 READX   JMP     (P)$
 BUF01   TIJ     BUFA$
         TJM     TIO$
         JMP     READ$
 LOAD    TMQ     1/1T3$
         ETA     CARDTYP$
         JAZ     LOADE$
         JMP     LOADSNO                      $
*                                             $
 LOADE   TMQ     1/1T7$
         ETA     CARDTYP$
         JAZ     LOADO$
*                                             $
         TMQ     1/1T0$
         JMP     ELMLOD$
 LOADSNOJMP      CASATTB                      $
         TMA     NUMELM$
         SLA     24$
         TAM     NOELM$
*                                             $
 TESTSNSTMQ      1/1T8$
         ETA     CARDTYP$
         JAZ     LOADE7$
 LSNCD   TMD     C/HLTL,SBLOC;C/HLT,STYPE$
         TDXLC   ,3$
         TDXRC   ,4$
         TMD     ,3$
         TDM     ,4$
         TMD     C/HLTL,STYPE+9$
         AIXO    1,3$
         AIXOL   1,4$
         JNO     (P)-5H$
         CA      $
         TMQ     STYPE$
         SLQ     12$
         SLAQ    18$
         TAM     STYPE$
         TMA     MASKBL$
         SLAQ    18$
         TAM     STAID$
```



```
 LOADE7  TMA     C/HLT,SATNOS                 $
         AM      NOELM                        $
         AM      N/1T15                       $
         TAM     IEEND                        $
         SRA     24$
         TAM     TEMP1$
         TMA     NOELM$
         TMQ     4/1;12/0;32/1$
         EIS     4S1 B$
         SRA     24$
         TMQ     28/1;12/0;8/1$
         EIS     4A 10D1$
         TMA     C/HLT,0;C/HLT,ORIGIN-1 $               K;25
         SM      TEMP1$
         SLA     17$
         TMQ     16/0;32/1$
         EI      D/0$
         TAM     AJNMBLK$
         TMA     IEEND$
         TAM     4LMAX$
         SCD     24$
         TDM     4RMAX$
         SM      N/2T15$
         TAM     4LMAX2$
         JMP     START6$
         JMP     NXTCASE$
 CASATTBTJM      CASXX$
         TMD     C/HLT,SATTB;C/HLT,SATNOS$
         TDXLC   ,3$
         TDXRC   ,4$
 CASPP   TMQ     MASKSAT$
         ETA     ,3$
         ETD     MASKBL$
         JAED    ELEND$
         TMQ     1/1T0$
         EA      MASK1$
         TAM     ,4$
         AIXO    1,3$
         AIXO    1,4$
         JMP     CASPP$
 ELEND   CA      $
         TAM     ,4$
 CASXX   JMP     (P)$
 LOADO   TIJ     LOAD A3$
         TJM     LOAD A4+1H$
         TIJ     4A10$
         TJM     LOADA7-1H$
 OPTIONOTMD      C/HLT,EBLOC;C/HLT,SATNOS$
         TDXLC   ,3$
         TDXRC   ,4$
         CQ      $
         JMP     ELMLOD$
         TMA     NUMELM$
         TMQ     18/1T29                      $
         TMD     D/400B39$
```

```
         JAGD     ECYCLES
NOCYCLEETA        ,3S
         ETD      MASKZS
         JAED     NOMORES
         SRA      18                          S
         TAM      ,4S
         AIXO     16,3S
         AIXO     1,4S
         JMP      NOCYCLE                     S
         ASGN     PASSONE,M/3754S                          CN K-160
NOMORE   TMQ      24/1T47                     S
         ETA      ,3                          S
         ETD      MASKZ                       S
         JAED     (P)+4H                      S
         TMQ      18/1T29                     S
         ETA      ,3                          S
         JMP      NOMORE-5H                   S
         CM       ,4                          S
         TMA      NUMELMS
         SLA      24S
         AMS      NOELMS
*                                             S
         JMP      TESTSNSS
ECYCLE   DRANA*   400                         S

         ETD      16,3S
         SRD      18                          S
         TDM      1,4S
         TMA      D/400B15S
         AMS      NOELMS
         TMD      C/HLT,EBLOCS
         TDXLC    ,3S
         JMP      OPTION0+3HS

L  4S1     TJM    4S1 B+2H
           TMA    1/1
           JMP    (P)+3H
   4S1 A   TJM    4S1 B+2H
           CA
           TMQ    12/0;36/1
         TMD      C/HLT,SATNOSS
           TDXLC  ,1
L  4S1 B RPTA     1000S
         EIS      1,1S
           JMP
   4S2     TJM    (P)-1H
         TMD      C/HLT,BUFA+120;C/HLT,BUFB+120S
           AIXOL  ,3
           JOF    (P)+3H
           AIXOR  ,3
           JNO    (P)+2H
         JMP      RD6AS
            TMA   ,3
           TMD    W/END CASE
           JAED   4S2-1H
```



```
               TMD    W/ENDSCHED
               JAED   (P)+4H
               TMA    N/1T16
               AMS    4S2-1H
               JMP    4S2-1H
               TIJ    4S3 A
               TJM    NXTCASE
               JMP    4S2-1H
R  4S3         TJM    (P)+4H
               TMA    W/END CASE
R              RPTAN  12
               TMD    10,3
               JAED
               TMA    W/ENDSCHED
R              RPTSN  13
               TMD    10,3
               JAED   4S3 A
             JMP      RD6AS
               JMP    4S3+1H
             A/END FAN INPUTS

   4S3 A       TMA    N/13T15;P/(P)-2,T39
               JMP    FLEX
               JMP    PANT.ALLFIN
             TIJ      NXTCAS1+1HS
             TJM      NXTCAS1S
               JMP    NXTCASE+1H
   4S4         TJM    4S4 A-1H S BIT 47=1,ERROR
               CD              S      46=1,COMMA
               SIXO   1,0      S      45=1,DASH
               JOF    4S4 A    S      44=1, ENDCASE
               TMQ    4T11
               CA
               SLAQ   6
               TQM    4T11
               TMD    0/60T47
               JAED   4S4+1
               TMD    W/0000000,
             JAED     (P)+2S
               TMD    W/0000000-
             JAED     (P)+2S
               JMP    4S4 A-1
               TMD    1/1T46
               JMP    (P)+2
               TMD    1/1T45
               JMP    (P)+1
               TMD    1/1T47
               DORMS  4T9
               SRAQ   6
               JMP
   4S4 A       AIXO   1,3
               SIXO   1,1
               JNO    (P)+2
               JMP    4S2
               JMP    (P)+3
```

```
         TIXZ  10,1
         TIXZ  9,0
         TMD   ,3
         TDM   4T11
         JMP   4S4+1H
         TMD   1/1T44
         JMP   4S4 A+3H
4S4 B    TJM   4S4 B3+5H
         CM    4T9
         CM    4T6
        TIXZ   5,2                      $
         JMP   4S4
         TMA   4T6
         SLAQ  6
         TAM   4T6
         TMA   4T9
         JAZ   4S4 B3
4S4 B1   TMD   N/10T15
         AIXO  0,1
         JOF   4S4 B2
         SIXO  1,3
         AIXO  1,1
         JOF   (P)+2H
         JMP   (P)-3H
4S4 B2   TMQ   30/1'18/0
         TMA   STAN
         EIS   4S4 B3-1
        TMA    N/16T15;P/4S4 B3-3,T39$
         JMP   FLEX
        JMP    PANT.SPACE
         TMA   N/3T15;P/4S4 B3-3,T39
         JMP   PANT
         TMQ   4T9
         SRQ   3
         JQO   NXTCASE
         AIXO  10,3
         JMP   4S2
         JMP   NXTCASE
         JMP   (P)-3H

        W/ERROR ON
        W/ ALL BUT
        W/ OR ONLY
        W/ CARDS
        W/CASE REJ
        W/-INP ERR
        W/-STA XXX
4S4 B3   SIXO  1,2
         JNO   4S4 B+4H
         JMP   4S4
        TMA    4T9
        JAZ    (P)+2H
         JMP
        TMA    N/4T15;P/4S4 B3-7,T39
        JMP    PANT
```



```
          JMP     4S4 B1
4BCDADD   TJM     (P)+6H
          AM      W/000WWWWX
          TAQ
          ES      W/
          SRD     3
          SD
          JMP
*
          0/7777777777777777
          0/6060606060603254
          JMP
4HEAD     TJM     (P)-1H
          TIJ     PANT.TPANTAS
          TJM     4OUT1+2H $
          TMA     N/2T15;P/(P)-8H,T39$
          JMP     4OUT 1              $ LINE 1
          TMD     L/STADR+20          $ LINE 2
          TDXLC   ,7
          JMP     4HEAD 4
          TMD     C/HLT,STADR+30;C/HLT,8
          TDM     4SAVE 02
          TMQ     W/DE
          TQM     DUM
          TIXZ    18,1
          JMP     4OUT 5
          TMQ     STADR+1
          JMP     4OUT 5D
          JMP     4OUT 5B
          TIXZ    48,1                $ LINE 3
          TMQ     AJMSGNO
          CA
          SLAQ    6
          JAZ     (P)+2H
          JMP     (P)+3H
          SIXO    6,1
          JMP     (P)-5H
          SRAQ    6
          TQM     DUM
          JMP     4OUT 5
          TIXZ    12,1$
          TMQ     W/H
          TQM     DUM
          JMP     4OUT 5
          TIXZ    48,1$
          TMQ     STADR+10$
          TQM     DUM$
          JMP     4OUT 5$
          JMP     4OUT 5C
          JMP     4HEAD 4
          TMA     AJMSGNO
          JMP     4BCDADD
          TAM     AJMSGNO

R         TMA     CLSFY               $ LINE 4 IF UNCLAS
```

```
         JAZ      (P)+4H
         JMP      (P)+5H
         A/ZNR;0/3232323254
         TMA      N/1T15;P/(P)-2H,T39
         JMP      4OUT 1
         TMD      L/STADR+40
         TDXLC    ,7
         JMP      4HEAD 4            $ LINE 5(4)
         JMP      4HEAD 4            $ FM LINE
         JMP      4HEAD 4            $ TO LINE
         TMA      ,7
         TMD      W/
         JAED     (P)+2H
         JMP      (P)-4H
         TMA      C/HLT,1;C/HLT,AFGRNCS
         JMP      4OUT 1
         JMP      4HEAD-1H
  AFGRNC A/AFGRNC;0/3254
  4HEAD 4 TJM     4OUT 1+5H
         TMD      N/9T15
         TXDRC    ,7
         TDA
         AIXO     10,7
         JMP      4OUT 1+1H
*
  4OUT 1    TJM   (P)+5H
            TAD
            JMP   PANT.TPANTA
            TAD
            JMP   PANT
            JMP
L            JMP
  4OUT 2     TJM  (P)-1H $ INSERT 0/32 IF HALF WORD BLANK
         TXDLC    ,4
         TDXLC    ,0
         SIXO     10,0
            TXDLC,0
            TDXLC,2
            TIXZ 1,1
            TMQ  24/1;24/0
            ETA  ,2
            ETD  W/
         JAED     4OUT 2A-2H $
            SRQ  24
            ETA  ,2
            ETD  W/
            JAED  4OUT 2B
            AIXO 1,2
         TMD      N/10T15
            AIXO 1,1
         JNO      4OUT 2+7H
            TMD  0/32
            TDM  ,2
  4OUT 2A SIXO    1,2
         JMP      4OUT 2C
```



```
            CD
            TXDLC,1
            TXDRC,0
            TDA
         TDM      9,0
            JMP   4OUT 2-1H
  4OUT 2B JMP     4OUT 2C
         JMP      4OUT 2A+2H
*
  4OUT 2C TJM     (P)+5H
         TMQ      6/1T47
         ETA      W/
         ETD      ,2
         JAED     (P)+2H
         JMP
         TMA      ,2
         EI       8/011010
         TAM      ,2
         JQN      (P)-4H
         JQO      (P)+1H
         SLQ      6
         JMP      4OUT 2C+2H

  4C1    W/SAT, SUM
         W/MARY FOR
         W/ STA-XXX
  4C2    W/DECAYING
  4C3    W/100 DAYS
         A/ PAST EPOCH    $

  4C4    W/SAT,NO./
         W/SET NO.
         $
*
  4SAVE02S
         TMD      4SAVE 02
         TXDLC    ,2
         TXDRC    ,0
         TDM      4SAVE 02
         JMP
  4OUT 5 TJM      (P)-1H
         TMD      4SAVE 02
         TDXLC    ,2
         TDXRC    ,0
         TDM      4SAVE  02
         TMQ      DUM
         SLAQ     6
         TQM      DUM
         JMP      (P)+5H
  4OUT 5A CD
         SIXO     6,1
         JNO      (P)-6H
         JMP      4OUT 5-5H
         TMQ      42/1;6/0
         EIS      ,2
```

```
         CD
         SIXO     1,0
         JNO      (P)+4H
         AIXO     1,2
         TIXZ     8,0
         JMP      4OUT 5A
         SLA      6
         TAM      ,2
         JMP      4OUT 5A
4OUT 5B  TJM      4OUT 5-1H
         TIXZ     6,1
         TMD      W/
         JMP      (P)+4H
4OUT 5C  TJM      4OUT 5-1H
         TIXZ     48,1
         TMD      7/011010;1/101100
         TDM      DUM
         JMP      4OUT 5+1H
4OUT5D   TJM      4OUT5-1H $
         TQA      $
         TIXZ     0,1 $
         TIXZ     M/60,0$
         SRAQ     6$
         TQD      $
         SRD      10 $
         SIXO     ,0$
         JOF      (P)+3H $
         AIXO     6,1$
         JMP      (P)+2H $
         SLQ      6 $
         JAZ      (P)+2H $
         JMP      (P)-9H $
         TQM      DUM $
         JMP      4OUT5+1H$

         $
4SMRYX   $
         TMD      4SMRYX$
         TDXLC    ,6$
         JMP      (P)$
4SUMMRY  TJM      (P)-1H$
         TXDLC    ,6$
         TDM      4SMRYX$
         TIJ      4OUT1+3H
         TJM      4OUT1+2H
         JMP      PANT.PAGE
         JMP      4CLEAR
         TMA      STAN
         TMQ      30/1;18/0
         EIS      4C1+2
         TMA      N/3T15;P/4C1,T39
         JMP      4OUT1
         JMP      PANT.SPACE
         TIJR
         TJM      4NXTEL+6H$
```



```
         JMP      4SET
         JMP      PANT.SPACE
         JMP      PANT.SPACE
         JMP      4CLEAR
         TMA      N/1T15;P/4C2,T39
         JMP      4OUT1
         JMP      PANT.SPACE
         TIJR     47
         TJM      4NXTEL+6H$
         JMP      4SET
         JMP      PANT.SPACE
         JMP      PANT.SPACE
         JMP      4CLEAR
         TMA      N/3T15;P/4C3,T39
         JMP      4OUT1
         JMP      PANT.SPACE
         TIJR     46
         TJM      4NXTEL+6H$
         JMP      4SET
         JMP      PANT.SPACE
         JMP      PANT.SPACE
         JMP      4CLEAR
         TMA      N/2T15;P/4C4,T39
         JMP      4OUT1
         JMP      PANT.SPACE
         TMD      C/HLT,SATNOS                  $
         TDXLC    ,1$
         TMD      L/4BFR$
         TDXLC    ,0$
         CSM      D/1847$
         TAM      4T13$
         CM       4T14$
NXTSET   TMQ      18/1T47$
         ETA      ,1$
         JAZ      NONXSET$        END OF SATNOS TABLE
         TMQ      ,1$
         JQN      (P)+3H$         CHECK  THIS SATELLITE
         AIXO     1,1$
         J        NXTSET$
         TAM      SATN$
         JMP      NXTELM$         GET.EL. SET NO.
         NOP      $
         TMQ      18/1T47                 $
         ETA      SATN                    $
         JMP      BINBCD$        CONVERT TO BCD
         TMD      BCDSAT$
         TDM      4T7$
         TMA      ELNO$
         JMP      BINBCD$
         TMD      BCDSAT$
         TDM      4T8$           EL SET NO. IN BCD
         TMA      D/1847$
         AMS      4T13$
         JAZ      SATONE$
         J        SATTWO$
```

```
*        THERE WILL BE 4 GROUPS OF THE FOLLOWING PER LINE OF
*        OUTPUT FOR SATNO./ELNO. EACH GROUP CONTAINS 3 WORDS
*       (SSSSS/EE) ,(EE  SSSS) ,(S/EEEE  )

*         FIRST SAT. IN GROUP
  SATONE TMA     4T7$              (000SSSSS)
         TMQ     0/61T5$           SLASH
         SLAQ    6$                (00SSSSS/)
         TMQ     4T8$              (0000EEEE)
         SLQ     24$               (EEEE0000)
         SLAQ    12$               (EE000000)=Q
         TAM     0,0$              (SSSSS/EE)=A
         SLAQ    12$                (000000EE) =A
         TMQ     MASKBL$
         SLAQ    12$
         TAM     1,0$               (0000EE  ) =A
         AIXO    1,0$
         AIXO    1,1$
         J       NXTSET$

*         SECOND SAT. IN GROUP
  SATTWO TMA     0,0$              (0000EE  )
         TMQ     4T7$              (000SSSSS) =Q
         SLQ     18$               (SSSSS000) =Q
         SLAQ    24$               (EE  SSSS) =A
         TAM     0,0$
         SLAQ    6$
         TMQ     0/61T5$             SLASH
         SLAQ    6$
         TMQ     4T8$
         SLQ     24$
         SLAQ    24$                 (S/EEEE00)
         TMQ     MASKBL$
         SLAQ    12$                 (S/EEEE  )
         TAM     1,0$              (S/EEEE  )
         AIXO    2,0$
         AIXO    1,1$
         CSM     D/1847$
         TAM     4T13$
         TMA     D/1847$
         AMS     4T14$
         TMD     D/4847$
         JAED    (P)+2H$
         J       NXTSET$
         CM      4T14$
         TMA     N/12T15;P/4BFR,T39$
         JMP     4OUT1$
         JMP     4CLEAR$
         TMD     L/4BFR$
         TDXLC   0,0$
         J       NXTSET$
```

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```
*        END OF SATNOS TABLE
  NONXSETCD      $
         TXDLC   0,0$
         TDA     $
         SM      C/HLT,4BFR;C/HLT,0$
         TAM     4T7$
         JAZ     4SUMMRY-3H$
         TMA     4T13$
         JAZ     SET00$
         J       SET11$

*        FIRST SAT. IN GROUP
  SET00  TMA     0,0$              (0000EE  )
         TMQ     MASKBL$
         SLAQ    24$               (EE      )
         TAM     0,0$
         J       SETEND$

*        SECOND SAT. IN GROUP
  SET11  TMA     4T7$
         AM      P/4BFR,T39$
         J       SETEND+1$
  SETEND TMA     4T7$
         AM      C/HLT,1;C/HLT,4BFR$
         JMP     4OUT1$
         JMP     4SUMMRY-3H$
  BINBCD TJM     BINDONE$        BIN.SAT. NO. IN (A)
         CM      BCDSAT$
         TAQ     $
         TIXZ    0,2                       $
  NXTCHARCA      $
  BINDONEJAEQ    (P)$            BIN.NO. NOW CONVERTED TO BCD
         DAQ     D/10$
         SLA     0,2                       $
         AMS     BCDSAT$
         AIXO    6,2                       $
         JMP     NXTCHAR$

L 4CLEAR   TJM   (P)+7H
           TMD   L/4BFR
           TDXRC ,3
           TMD   W/
L        RPTA    11
           TDM   1,3
         SIXO    11,3
           JMP
L          TAQ
           TMA   1/1T16
           AMS   (P)+1
           TQA
           JMP
```

```
4NXTEL   TJM    (P)-1H
         TMQ    18/1T47$
          ETA   ,1
         JAZ    4NXTEL-1H$
          TMD   ,1
         AIXO   1,1$
          SCD
          JDP   (P)-6H
          JMP   4NXTEL-5H
4SET      TJM   4SET3-1H
         TMD    C/HLT,SATNOS                 $
         TDXLC  ,1$
          TMD   L/4BFR
          TDM   4T6
         CSM    D/1B47$
         TAM    4T13$
         CM     4T14$
          JMP   4NXTEL
          NOP
          TAM   4T7
4SET 1    JMP   4NXTEL
          JMP   4SET 2
          TAM   4T8
          TMA   4T7
         AM     D/1B47$
         TMD    4T8$            SAT.NOS. CONSECUTIVE ?
         JAED   4SET 3$         YES
         TMA    4T7$
         JMP    BINBCD$
          JMP   4COMMA
          JMP   4SET1
4SET2    TMA    4T7$
         JMP    BINBCD$
         JMP    4BLANK$
         TMA    4T6$                4BFR+? IN BOTH HALVES
         TDXLC  ,0$
         SM     C/HLT,4BFR$
         TAM    4T7$
         TMD    C/HLT;C/HLT,4BFR$   BUFFER EMPTY ?
         JAED   (P)+2H$             MAYBE
         J      GROUPCK$            NO
         TMA    4T13$
         JAN    4SET3-1H$           BUFFER IS EMPTY
         J      GROUPCK$            AT LEAST 1 SATNO. TO PRINT
         TMA    D/12B15$
INSERT   TMQ    1/1;15/0;32/1$
         EIS    SLAQ$
         J      ASBL$
GROUPC<TMQ      4T13$
         JQO    AS2OR4$          2ND OR 4TH SATNO. IN GROUP
AS0OR2   JQO    AS3$             3RD
         J      AS1$             IST
AS2OR4   JQO    SLAQ+2H$         4TH
         J      AS2$             2ND
AS1      TMA    D/12B15$        FIRST SAT. IN GROUP
```

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```
         J      INSERT$
AS2      TMA    D/24B15$        SECOND SAT.IN GROUP
         J      INSERT$
AS3      TMA    D/36B15$        THIRD SAT. IN GROUP
         J      INSERT$
ASBL     TMA    ,0$
         TMQ    MASKBL$
L SLAQ   SLAQ   0$
            TAM ,0
         TMQ    15/1T15$
         ETA    4T7$              NO. WORDS TO PRINT IN LEFT
         AM     C/HLT,1;C/HLT,4BFR$ HALF OF A REG. STARTING
*                                 ADDRESS IN RIGHT HALF
            JMP 4OUT 1
            JMP
4SET 3   TMA    4T7$
         JMP    BINBCD$
         JMP    4DASH$
          JMP   4NXTEL
          JMP   4SET 2
          TAM   4T8
          TMA   4T7
         TDM    4T9
         AM     D/1B47$
          TAM   4T7
          TMD   4T8
         JAED   4SET3+3H               $
         TMD    4T9
         TDM    4T7
         JMP    4SET2-4H               $
4SLASH      TMQ W//
         TJM    4DONE$
         JMP    INSERTA$
4BLANK     TMQ  W/
         TJM    4DONE$
         JMP    INSERTA$
4COMMA   . TMQ  W/,
         TJM    4DONE$
         JMP    INSERTA$
4DASH      TMQ  W/-
         TJM    4DONE$
INSERTATMA      BCDSAT$         SAT.NO. IN BCD AT T47
         SLAQ   6$
         TAM    4T7$
           JMP  4HALF
4RESET   TMD    4T8$
           TDM  4T7
4DONE    JMP    (P)$
4HALF    TMD    4T6$            4BFR TO
         TDXLC  ,0$             0X
         TMA    4T14$           GROUP COUNT
         TMD    D/3B47$
         JAED   SAT13$          LAST SAT. ON THE LINE-13TH.
         TMA    D/1B47$
```

```
        AMS     4T13S           COUNTS NO, IN GROUP
        TAQ     S
        JQO     SAT2OR4S
SAT002  JQO     SAT3S
        J       SAT1S
SAT2OR4JQO      SAT4S
        J       SAT2S
SAT1    TMD     4T7S            FIRST SAT. IN GROUP
        TDM     ,0S             (0011111,)
        J       4RESETS        XO NOT INCREMENTED HERE
SAT2    TMA     ,0S             (0011111,)
        TMQ     4T7S            SECOND SAT. IN GROUP
        TDM     1,0S            (0022222,)
        SLQ     12S             (22222,00)
        SLAQ    12S             (11111,22)
        TAM     ,0S            (11111,22)
        AIXO    1,0S
        J       ASENDS
SAT3    TMA     ,0S             (0022222,) =A
        TMQ     4T7S            THIRD SAT IN GROUP
        TDM     1,0S            (0033333,)
        SLQ     12S             (33333,00) =Q
        SLAQ    24S             (222,3333) =A
        TAM     ,0S            (222,3333) =ABUF+1 IST TIME
        AIXO    1,0S
        J       ASENDS
        TAM     ,0S             (11111,22)
SAT4    TMA     ,0S             (0033333,)
        TMQ     4T7S           4TH AND LAST SAT IN GROUP
        SLQ     12S
        SLAQ    36S             (3,44444,) =A
        TAM     ,0S
        AIXO    1,0S
        TMA     D/1847S
        AMS     4T14S
        CSM     D/1847S
        TAM     4T13S
        J       ASENDS
SAT13   TMA     4T7S            LAST=13TH. SAT. ON LINE
        TMQ     MASKBLS
        SLAQ    12S
        TAM     ,0S             XXXXX,   **
        CM      4T14S
        TMA     N/10T15;P/4BFR,T39S
        JMP     4OUT1S
        JMP     4CLEARS
        TMD     L/4BFRS
SETBFFRTDM      4T6S
        JMP     4HALF+3HS
ASEND   CD      S
        TXCLC   ,0S
        JMP     SETBFFRS
BCDSAT  S
4T13    S
4T14    S
```



```
REWIND    TJM    (P)+4H
          JMP    SYS
          TIO    ABUF
          JMP    SYSNO
          JMP
NXTCASE   JMP    PANT.FINISH                   S OR 4S3 A
        CM       PHAIN                         S
          TMA    N/7T23;H/8AT47
          JMP    REWIND
          TMA    N/8T23;H/8AT47
          JMP    REWIND
          TMA    N/9T23;H/8AT47
          JMP    REWIND
NXTCAS1JMP       (P)+3HS
        JMP      SATLODS
        JMP      MANEXIT                       S
*
* RESET
*
        CM       PASSONES                                   CN K-160
        CQ       S                                          CN K-160
        JMP      ELMLODS                                    CN K-161
        CM       AJDNCNT S
        TMD      W/   MORE S
        TDM      AJMRDTAS
        TIJ      AJINSMR+1H S
        TJM      AJINSMR    S
*                                              S
        TMD      W/ SAT   R
        TDM      AJLN12
        TMD      W/EV    TI
        TDM      AJLN12+1
           TMD   C/JMP,SYS;C/TIO,AJBFFX
          TDM    AJWT89+1
          TIJ    AJPKITA+3H
          TJM    AJPKITA-1H
           TIJ   AJDYCK
          TJM    AJDLOOP
        TIJ      GLOP.TGLOP
          TJM    AJCLU+3H
        TIJ      GLOP.GLOP
          TJM    AJHDU+3H
          TMD    C/ICOZ,27*128+1;C/TMA,AJELEV
          TDM    AJFWL6
          TMD    C/ICOZ,34*128+1;C/TMA,AJAZ
          TDM    AJFWL7
        TIJ      AJDAYSS                       S
        TJM      AJ1OUT                        S
        TMD      C/HLT,17*128+17;C/TMA,AJUNS
        TDM      AJFCL
        TMD      C/HLT,34*128+34;C/TMA,AJCONS
        TDM      AJFCF
        TMD      C/HLT,22*128+22;C/TMA,AJSCS
        TDM      AJFSC
        TMD      C/HLT,34*128+34;C/TMA,AJNFS
```

```
          TDM     AJFNF
          TMD     C/HLT,54*128+54;C/TMA,AJACN2$
          TDM     AJACN1
          TMD     W/                            $
          TDM     AJBFFR                        $
          JMP     PANT.PAGE            $
*
* READ SENSOR FILE
  READSNSJMP      SNSGETS
          TMD     C/HLT,SBLOCS
          TDXLC   ,3$
          TMD     IEENDS
          TDXLC   ,4$

R         RPTAA   9$
          TMD     1,3$
          TDM     1,4$
          SIXO    9,3$
          TMA     ,3$
          TMD     MASKBLS
          JAED    (P)+3H$
          AIXO    9,3$
          JMP     (P)-8H$
*
* CASE BY PASS OPTION
*
  4A 1    JMP     RD6AS
            TMA   ,3
            TMD   W/ENDSCHED
            JAED  4S3 A
            TMD   W/END CASE
            JAED  4A 1
            TAM   4A3-1
            TMA   N/12T15;P/4A3-2,T39
            JMP   FLEX
            TTD
            SCD   1
            JDP   4A 4
            JMP   4A 2
  4A 1A     JMP   4S3
          JMP     RD6AS
            TMA   ,3
          JMP     4A 1+6H
  4A2     JMP     STOPGOS
          JMP     4A 4$
          JMP     4A 1A$
          A/STATION XXXX$

  4A3     A/JAN$
          A/FEB$
          A/MAR$
          A/APR$
          A/MAY$
          A/JUN$
          A/JUL$
```



```
          A/AUG$
          A/SEP$
          A/OCT$
          A/NOV$
          A/DEC$
*                                              $
*
* ERROR OUTPUT
*
AJERRORNOP
          TMA     N/6T15;P/AJERR7,T39
            JMP   PANT
            TMA   N/10T15
            TXDRC ,3
            JMP   PANT
          TMD     4S4 B3-2
          TDM     4T9
          JMP     4S2
            JMP   4S4 B2
          AIXO    10,3
          JMP     (P)-3H
*
* DETERMINE TIME
*
4A 4        JMP   AKLOK
            TQM   ZULUT
            SLQ   12
            TQM   TFN
            TMD   L/4A3-1
            TDXLC ,0
            SRAQ  7
            CA
            SLAQ  7
            TMD   D/64
            JAGD  (P)+7H
            SLA   8
            TAD
            ADXR  0,0
            TMD   0,0
            TDM   MONTH
            JMP   (P)+3H
            SM    D/54
            JMP   (P)-7H
            JMP   FKLOK
            JMP   FYKLOK
            JMP   AJFIXIT
            TAM   DFN
*
* PROCESS CONTROL CARD
*
          TIJ     4S2
          TJM     AJERROR+8H
            TMQ   12/1T47
            ETA   9,3
             TMD  W/000000RP
```

```
            JAED   (P)+3H
            TMA    N/7T15;P/AJERR1,T39
             JMP   AJERROR+1S
            TMA    C/HLT;C/TIJL,AJSRFWR
            JMP    XSRCH
            JAZ    AJERROR
*
          TMA      8,3
          SLA      35
          JAP      4A 4AA
          TMD      C/HLT,17*128+17;C/TMA,AJUN1S
          TDM      AJFCL
          TMD      C/HLT,34*128+34;C/TMA,AJCON1S
          TDM      AJFCF
          TMD      C/HLT,22*128+22;C/TMA,AJSC1S
          TDM      AJFSC
          TMD      C/HLT,34*128+34;C/TMA,AJNF1S
          TDM      AJFNF
          TMD      C/HLT,54*128+54;C/TMA,AJACN3S
          TDM      AJACN1
   4A 4AA TMA      BASE
            FAM    BEGT
            TMQ    YEAR
            JMP    BKLOK
            TAM    BEGT
            TDM    FDAY
            TMA    BASE
            FAM    ENDT
            JMP    BKLOK
            TAM    ENDT
          FSM      BEGT                                  S
          TMQ      F/29                                  S
          JAGQF    TIME OUT                              S
*
          CM       RSU                                   S
          CM       RSV                                   S
          CM       RSW                                   S
          TMD      0/32;7/110000                         S
          TDM      AJUNITS+1                             S
          TMQ      W/    (NM)                            S
          TMA      RNGFLAG                               S
          JAZ      (P)+2H                                S
          TMQ      W/    (KM)                            S
          TQM      AJUNITS                               S
          TMD      A/E;0/32;6/110000                     S
          TDM      AJLN12+6                              S
          TMQ      W/                                    S
          TMA      ELFLAG                                S
          JAZ      (P)+5H                                S
          TMD      A/E  FAN;0/3260                       S
          TDM      AJLN12+6                              S
          TQM      AJUNITS+1                             S
          TMQ      A/  NO.;0/32;A/  S                    S
          TQM      AJUNITS+2                             S
          TMD      W/                                    S
```



```
          TDM      AJUNITS+3                             S
          TDM      AJUNITS+4                             S
          TDM      AJUNITS+5                             S
          TDM      AJLN12+7                              S
          TDM      AJLN12+8                              S
          TDM      AJLN12+9                              S
          TMA      DRCOSFL                               S
          JAZ      BYPASS2                               S
          TMD      W/   U                                S
          TDM      AJUNITS+3                             S
          TMD      W/   V                                S
          TDM      AJUNITS+4                             S
          TMD      W/   W                                S
          TDM      AJUNITS+5                             S
          TMD      W/     DIRE                           S
          TDM      AJLN12+7                              S
          TMD      W/CTION CO                            S
          TDM      AJLN12+8                              S
          TMD      W/SINES                               S
          TDM      AJLN12+9                              S
*
  BYPASS2  TMA     PRIO                                  S
          TMD      W/
          JAED     AJERROR
            CM     AJ1STF
            TMA    CLSFY
            SLA    8
            TAM    CLSFY
            TMD    N/5T39
            JAGD   AJERROR
*
          TMA      ZFX                                   S
          TMQ      ZFY                                   S
          JMP      COMPL                                 S
          TDM      YFX                                   S
          TQM      YFY                                   S
          TAM      YFZ                                   S
          TMQ      DE2RA                                 S
          FMMRS    ZFX                                   S
          FMMRS    ZFY                                   S
S         FSIN                                           S

          TAM      XFX                                   S
S         FCOS     ZFY                                   S


          TAM      XFY                                   S
          TMD      F/0                                   S
          TDM      XFZ                                   S
S         FCOS     ZFX                                   S


          TAM      ZFZ                                   S
          TMQ      YFZ                                   S
          FMMR     XFY                                   S
```

```
        TAM     ZFX                          $
        FCSM    XFX                          $
        FMARS   ZFY                          $
        TMA     4C4+2
        JMP     (P)+5H                       $
*                                            $
*                                            $
        TMD     W/ SAT  EL
        TDM     AJLN12
        TMD     W/EM    TI
        TDM     AJLN12+1
*
*  UNPACK SENSOR RECORD
*
        CSM     D/1815$
        TAM     SATCONTS
          TMQ   1/1T8     $
          ETA   CARDTYP
          JAZ   (P)+9H
          TMQ   18/1T47
          ETA   STAN
          ETD   STAID
          JAED  LOAD S0
          TMD   W/N S AND
          TDM   AJERR9+1
          TMA   N/4T15;P/AJERR9,T39
           JMP  AJERROR+1$
        TMD     IEENDS
        TDXLC   ,4$
          TMQ   18/1T47
          ETA   ,4
          ETD   STAN
          JAED  LOAD S
        ETD     MASKBLS
          JAED  (P)+3H
          AIXO  9,4
          JMP   (P)-6H
          TMQ   24/0;24/1
          TMA   STAN
          SLA   24
        EIS     LOAD S-2
        TMA     N/3T15;P/LOAD S-3,T39
          JMP   AJERROR+5H

        A/STATION XXXX NOT ON SEAI$3

  LOAD S TMD     C/HLT,STYPE$
          TDXLC ,0
          CA
R         RPTAA 9
          TMD   1,4
          TDM   1,0
          TMQ   STYPE
          SLQ   12
```



```
            SLAQ  18
            TAM   STYPE
            TMA   W/
            SLAQ  18
            TAM   STAID
  LOAD S0   SLA   6
            TMQ   24/1;18/0;6/1
            EIS   LOAD S1-3H
            EIS   LOAD S1-5H
            EIS   LOAD S1-7H
            JMP   LOAD S1

          W/FROMXXXA
          W/TO  XXXA
          W/INFOXXXA
*
*  STORE  FAN AND ADDRESS DATA
L         HLT     IREC
  LOAD S1   TMD   (P)
            TDXLC ,0
            TMD   W/
L           RPTA  256
            TDM   1,0
          TMD     LOAD A$
          TDXRC   ,0$
          AIXO    10,3$
  LOAD F    JMP   4S2
          JMP     LOAD A1                    $
            TMQ   12/1T47
            ETA   9,3
            ETD   W/000000FP
          JAED    (P)+7H
            SRQ   6
          ETA     9,3
            ETD   LOAD S1-3H
            JAED  LOAD A
  LOAD F1 TMA     N/5T15;P/AJERR6,T39        $
            JMP   AJERROR+5H
          TMD     C/HLT,AJBFFR+150;C/HLT,(P)+4H$
            AIXJ  0,0
          TMA     N/5T15;P/AJERR5,T39        $
            JMP   AJERROR+5H
R           RPTAA 10
            TMD   1,3
            TDM   1,0
          TMD     W/                         $
          TDM     1,0                        $
            JMP   LOAD F
R LOAD F2 TJM     (P)+7H
          NOP     STADR+50
R           RPTAA 9
            TMD   1,3
            TDM   1,4
            AIXO  1,3
          AIXO    1,4
```

```
          JMP

L LOAD A TMA      W/
          TMD     AJBFFR
        JAED      CHKMEL                   $
        TAM       ,0
          TMA     9,3
          TMD     LOAD S1-7H
          JAED    (P)+3H
  LOAD A1  TMA    N/3T15;P/AJERR3,T39
          JMP     AJERROR+5H
          TMD     LOAD F2+1H
          TDXLC   ,4
*
        TMD       C/HLT,STADR+9;C/HLT,STADR-1
        TDM       STADR+9
        JMP       LOAD A7
        TIXZ      18,2
        TIXZ      30,1
        TMA       W/00000FM
        JMP       LOAD A9
        JMP       4S2
        JMP       LOAD A1
        TMA       9,3
        TMD       LOAD S1-5H
        JAED      (P)+2H
        JMP       LOAD A1
        JMP       LOAD A7
        TIXZ      18,2
        TIXZ      30,1
        TMA       W/00000TO
        JMP       LOAD A9
        JMP       4S2
        JMP       LOAD A1
        TMA       9,3
        TMD       LOAD S1-5H
        JAED      (P)+2H
        JMP       (P)+6H
        JMP       LOAD A7
        JMP       4OUT 2
        JMP       (P)-8H
  LOAD A3 TMA     N/5T15;P/AJERR10,T39
        JMP       AJERROR+5H
*
  LOAD A4 JMP     4S2
        JMP       LOAD A5
        TMA       9,3
        TMD       LOAD S1-3H
        JAED      (P)+2H
        JMP       LOAD A5
        JMP       LOAD A7
        TIXZ      30,2
        TIXZ      18,1
        TMA       W/000INFO
        TIJ       LOAD A6+1H
```



```
          TJM     LOAD A6
          JMP     LOAD A9
          JMP     4S2
          JMP     LOAD A5
          TMA     9,3
          TMD     LOAD S1-3H
          JAED    (P)+2H
          JMP     LOAD A5
          JMP     LOAD A7
          JMP     4OUT 2
          JMP     (P)-8H
*
          JMP     4S2
          JMP     4A20
          AIXO    10,3
          JMP     (P)-3H
  LOAD A5 TMD     C/HLT,STADR+20;C/HLT,8
          TDM     4SAVE 02
          TMA     PRIO
          SRAQ    12
          TQM     DUM
          TIXZ    12,1
          JMP     4OUT 5
          JMP     4OUT 5B
          TMD     L/STADR $
          TDXLC   ,7
          TMQ     0,7
          TDM     SAVE
          JMP     LDA5
  LDA5A   TMA     0,7
          TMD     W/
          JAED    LDA5B
          TMD     SAVE
          JAED    LDA5B
          TAM     SAVE
          JMP     4OUT5B
          TMQ     0,7
  LDA5    JMP     4OUT 5D
  LDA5B   TMD     STADR+9
          AIXOR   1,7
          JNO     LDA5A
          JMP     4OUT 5C
*
          TMD     C/HLT,STADR+40;C/HLT,8
          TDM     4SAVE 02
          TMA     PRIO
          SRAQ    12
          TQM     DUM
          TIXZ    6,1
          ETA     12/1T11
          ETD     W/YY
          JAED    (P)+5H
          ETD     W/00
          JAED    (P)+3H
          TIJ     LOAD A6+7H
```

```
        TJM     LOAD A6
        JMP     4OUT 5
        JMP     4OUT 5B
LOAD A6 JMP     (P)+7H
        TIJ     (P)+6H
        TJM     (P)-2H
        TMQ     W/P
        TQM     DUM
        TIXZ    12,1
        JMP     4OUT 5
        TMA     ZULUT
        TMQ     W/Z
        SRA     12
        SRAQ    36
        TQM     DUM
        TIXZ    42,1
        JMP     4OUT 5
        TMD     W/ ZEX
        TDM     DUM
        TIXZ    24,1
        JMP     4OUT 5
        JMP     4OUT 5C
*
        TMQ     ZULUT
        SLAQ    12
        SLA     6
        SLAQ    24
        SLA     6
        AM      0/61T17;0/71T47
        TAM     DUM
        TMD     C/HLT,STADR+10;C/HLT,8
        TDM     4SAVE 02
        TIXZ    48,1
        JMP     4OUT 5
        JMP     4OUT 5B
        TMD     MONTH
        TDM     DUM
        TIXZ    18,1
        JMP     4OUT 5
        JMP     4OUT 5B
        TMQ     STADR+1
        JMP     4OUT 5D
        JMP     4OUT 5C
        JMP     LOADA5-4H $
*
LOAD A7 TJM     LOAD F2+7H
        TMA     N/10T15
        TXDRC   ,3
        JMP     PANT
        TMA     W/
        TMQ     8,3
        JAED    LOAD A8
        TAM     8,3
        TMA     N/1T39
        AMS     STADR+9
```



```
        TDXRC   ,0
        SIXO    1,0
        JOF     LOAD A8+1
        TQM     0,0
        JMP     LOAD F2+1H
LOAD A8 TMA     N/3T15;P/AJERR11,T39
        JMP     AJERROR+5H
        TMA     N/3T15;P/AJERR12,T39
        JMP     AJERROR+5H
        $
LOAD A9 TJM     4OUT 2-1H
        TMD     LOAD A9-1
        TXDLC   ,4
        TDXLC   ,0
        SIXO    1,0
        TXDLC   ,0
        SIXO    9,0
        TXDRC   ,0
        TDM     LOAD A9-1
        TMQ     ,0
        SRAQ    ,2
        TMA     ,0
        TQM     ,0
        NOP     $
        TMD     LOAD A9-1
        AIXOL   1,0
        JNO     (P)-7H
        JMP     4OUT 2+1H
*
*
*  EDIT  ALL,ALL BUT, OR ONLY CARDS
*
4A 10     JMP     4S1
          TMA     ,3
          TMD     W/ALL
          JAED    4A 10A
          TMD     W/ALL BUT
          JAED    4A 10A+2
          TMD     W/ONLY
          JAED    4A 10A+3
          JMP     LOAD A3
*
4A 10A    JMP     4S2
          JMP     4A20
          AIXO    10,3
          JMP     (P)-3H
          CD
          JMP     (P)+3H
          JMP     4S1 A
          TMD     1/1
          TDM     4T3
        AIXO    1,3
        TIXZ    9,1
          TIXZ     9,0
          TMD     ,3
```

```
          TDM    4T 11
*
 4A 10B   JMP    4S4 B
          TMD    4T6
          TDM    4T5
          TMQ    4T9
          JQO    4S4 B1
          JQO    4A 10C+3H
          JQO    4A 10C+6H
*
 4A 10C   TIJ    4A 10F+1H
          TJM    4A 10F
          JMP    4A 10D-4H
          JQO    (P)+1H
          JQO    4A 10C
          JMP    4A 10D-4H
          JQO    4A 10C
          JMP    4S4 B
*
          TMQ    4T9
          JQO    4S4 B1
        JQO      (P)+3H $
          JQO    4S4 B1
        JMP      4A10C $
          TMA    4T5
          TMD    4T6
          JAED   (P)+2H
          JAGD   4S4 B1
*
 4A 10D TAQ                                    $
        CA                                     $
        JMP      FXINT                         $
        TAQ                                    $
        TMA      FXERCL                        $
        JAZ      4BCDADD-3H                    $
        TQA                                    $
        TMD      C/HLT,SATNOS                  $
        TDXLC    ,4$
        TMQ      18/1T47$
R 4A 10D1RPTAN   1000$
        ETD      1,4$
          JAED   (P)+2H
          JMP    4A 10E
        SIXO     1,4$
          TMQ    1/0;47/1
          TMA    4T3
          EIS    ,4
*
 4A 10E   TMA    4T5
          JMP    4BCDADD
          TAM    4T5
          TMD    4T6
          JAED   4A 10D
          JAGD   (P)+2H
          JMP    4A 10D
```



```
*
 4A 10F   JMP    4A 10B
          TIJ    4A 10B
          TJM    (P)-2H
*
 4A 20    TMD    P/AJBFFR,T15;P/FANTAB,T39
          TDXLC  ,3
          TDXRC  ,6
          TIXZ   ,5
*                                              $
        CM       TRFLG                         $
        CM       FNCONT                        $
        TIJ      FNOTAB                        $
        TJM      STIKFN                        $
          TMD    W/N R AND
          TDM    AJERR9+1
 4A 21    TMA    ,3
          TMD    W/
          JAED   (P)+2H
          JMP    AJFCARD
          TMD    W/ZZZZZZZZ
          TDM    ,6
        CM       PHAIN                         $
        TMQ      W/ZZZZZZZZ                    $
        TMA      FANTAB                        $
        JAEQ     AJNORMX                       $
        TMA      FANTAB+12                     $
        JAEQ     AJNORMX                       $
        TMD      P/FANTAB,T15                  $
        TDM      TEMP2                         $
        TDXLC    ,4                            $
        TMD      5,4                           $
        TDM      TEMP1                         $
 SRT1   AIXO     12,4                          $
        TMA      0,4                           $
        TMD      W/ZZZZZZZZ                    $
        JAED     SRT2                          $
        TMA      5,4                           $
        TMQ      TEMP1                         $
        JAGQF    SRT1                          $
        TAM      TEMP1                         $
        CD                                     $
        TXDLC    ,4                            $
        TDM      TEMP2                         $
        JMP      SRT1                          $
 SRT2   TMD      TEMP2                         $
        TDXLC    ,4                            $
        TMD      P/FANTAB,T15                  $
        TDXLC    ,6                            $

R       DRNNAA   12                            $
        TMA      0,4                           $
        TMD      0,6                           $
        TDM      1,4                           $
        TAM      1,6                           $
```

```
AJNORMX  TMD    P/AJBFFR,T15
         TDM    AJCOL79
         TMQ    BEGT                     $        DETERMINE
         JMP    AJFIXIT                  $        NUMBER
         SLA    17                       $        OF
         TMQ    F/1073741824.            $        MINUTES
         FMARS  AJHOLD                   $        EXPIRED
         TMA    BEGT                     $        IN
         FSM    AJHOLD                   $        BEGINNING
         TMQ    F/1440.                  $        DAY
         FMARS  AJHOLD                   $        REQUEST.
         TMA    RNGFLAG                  $        NM
         JAZ    (P)+2                    $        OR
         TMA    XKMPER                   $        KM
         TMQ    ERK2KMS                  $        CONVERSION
         JMP    (P)+2                    $        FACTORS
         TMA    ERK2KMS                  $        FOR
         FDA    F/1.852$                 $        RANGE CNT260
         TMA    XNMPER                   $        AND
         TAM    AJCNV1                   $        RANGE
         TQM    AJCNV2                   $        RATE.
         JMP    START1                   $
AJFCARDTMA      C/HLT,0:C/TIJL,AJSRFWE    $ SET UP FANTAB FROM F CARDS
         JMP    XSRCH                     $ AND CHECK INPUT.
         JAZ    AJERROR                   $
         TMA    AJFNTAB                   $
         FAM    F/90.0                    $
         JAP    AJREGFN                   $
         TMA    TRFLG                     $ INTERPRET TRACKER CARD
         JAZ    (P)+3H                    $
         TIXZ   1,4                       $
         JMP    TRERR                     $
         TMD    F/5                       $
         TDM    PHAIN                     $
         TIXZ   0,4
         TMA    C/HLT,0:C/TIJL,AJSRFWF    $
         JMP    XSRCH                     $
         JAZ    THERR
         TMD    L/TEMP0                   $
         TDXLC  ,4                        $

R        RPTAA  11                        $
         TMD    1,4                       $
         TDM    1,6                       $
         SIXO   11,6                      $
         TMA    10,6                      $
         JAZ    AJFC1                     $
         TIXZ   2,4                       $
         TMQ    0,6                       $
         FMMR   0,6                       $
         FSM    F/1                       $
         JAP    TRERR                     $
         TAQ                              $
         FCSQ                             $
         TMQ    F/1                       $
```



```
                 JAEQ    TRERR                  $
S                FSQRT                          $

                 TAM     3,6                    $
                 TMQ     1,6                    $
                 FMMR    1,6                    $
                 FSM     F/1                    $
                 JAP     TRERR                  $
                 TAQ                            $
                 FCSQ                           $
                 TMQ     F/1                    $
                 JAEQ    TRERR                  $
S                FSQRT                          $

                 TAM     4,6                    $
                 TMQ     DE2RA                  $
                 FMMRS   AJFNTAB+2              $
                 TMD     F/0                    $
                 JAED    TRERR                  $
S                FCOS                           $

                 TAM     2,6                    $
S                FSIN    AJFNTAB+2              $

                 TAM     SINPSI                 $
         AJFC1   TIXZ    3,4                    $
                 TMA     7,6                    $
                 TMQ     F/2                    $
                 JAGQF   (P)+2H                 $
                 JMP     TRERR                  $
                 TIXZ    4,4                    $
                 TMD     F/9                    $
                 JAED    (P)+2H                 $
                 JMP     AJFC2                  $
                 FCAMAS  8,6                    $
                 TMD     F/0                    $
                 JAED    TRERR                  $
         AJFC2   TMA     RCPTST                 $
                 JAZ     AJFC3                  $
                 TIXZ    5,4                    $
                 TMA     F/0                    $
                 TMQ     9,6                    $
                 JAGQF   TRERR                  $
                 FMMR    ERPKM                  $
                 TAM     9,6                    $
         AJFC3   TMA     AJFNTAB+1              $
                 TMQ     F/90                   $
                 TIXZ    6,4                    $
                 JAGQF   TRERR                  $
                 TMQ     DE2RA                  $
                 FMARS   AJFNTAB+1              $
S                FSIN                           $

                 TAM     5,6                    $
```

```
S         FCOS    AJFNTAB+1              $

          TAM     6,6                    $
          TMD     0/37:0/63T47           $
          TDM     11,6                   $
          TMA     ELMAX                  $
          TMD     F/0                    $
          JAED    (P)+4H                 $
          TMQ     DE2RA                  $
          FMARS   ELMAX                  $
          JMP     (P)+3H                 $
          TMD     F/2                    $
          TDM     ELMAX                  $
          TJM     TRFLG                  $
          AIXO    1,5                    $
          AIXO    10,3                   $
          AIXO    12,6                   $
          JMP     4A21                   $
   TRERR  TMA     C/HLT,5;C/HLT,TRCOM7   $
          JMP     PANT                   $
          TMA     N/10T15                $
          TXDRC   ,3                     $
          JMP     PANT                   $
          TMD     P/TRCOM-1,T39          $
          ADXR    ,4                     $
          TMA     ,4                     $
          JMP     PANT                   $
          AIXO    10,3                   $
          JMP     PANT.SPACE             $
          JMP     4A21                   $

L         HLT     7                      $
          HLT     AJERR7
L TRCOM   HLT     4                      $
          HLT     TRCOM1                 $
          HLT     4                      $
          HLT     TRCOM2                 $
          HLT     3                      $
          HLT     TRCOM3                 $
          HLT     2                      $
          HLT     TRCOM4                 $
          HLT     3                      $
          HLT     TRCOM5                 $
          HLT     4                      $
          HLT     TRCOM6                 $
   TRCOM1 A/ONLY 1 TRACKER CARD ALLOWED$


   TRCOM2 A/LIMITS ON BORESIGHT ANGLES WRONG$


   TRCOM3 A/POINTS PER PASS WRONG$
```



```
   TRCOM4 A/DELTA T IS ZERO$

   TRCOM5 A/MAX. RANGE IS WRONG$


   TRCOM6 A/MIN. ELEV. GREATER THAN 90$


   TRCOM7 A/ERROR ON TRACKER CARD. CARD REJECTED$



L AJSRFWFICOZ     6*128+6                $
          TMA     AJFNTAB                $
          ICOZ    24*128+6               $
          TMA     AJFNTAB+1              $
          ICOZ    25*128+1               $
          TMA     TEMP7                  $
          JBT     27*128+1               $
          TMA     TEMP10                 $
          ICOZ    36*128+6               $
          TMA     TEMP8                  $
          ICOZ    42*128+6               $
          TMA     TEMP0                  $
          ICOZ    48*128+6               $
          TMA     TEMP1                  $
          ICOZ    54*128+6               $
          TMA     AJFNTAB+2              $
          ICOZ    66*128+6               $
          TMA     ELMAX                  $
          ICOZ    60*128+6               $
          CAM     TEMP9                  $
L RSTSTWDHLT      0                      $
          HLT     AJREG1                 $



   AJREGFNAIXO    3,3                    $
          TMD     RSTSTWD                $
          TXDLC   ,3                     $
          TDM     RSTSTWD                $
          AIXO    5,3                    $
          TMQ     1,3                    $
          TMD     F/6                    $
          TDM     PHAIN                  $
   AJREG1 TMA     0,3                    $
          SRAQ    6                      $
          TQM     1,3                    $
          SRAQ    42                     $
```

```
         TMD     RSTSTWD                        $
         SIXJ    1,3                            $
         SIXO    3,3                            $
         TMA     0/60T47                        $
         TMQ     42/1T41                        $
         EIS     4,3                            $
         EIS     9,3
         TJM     FNFLG                          $
AJREG2   TMA     0,3                            $
         TMD     W/                             $
         JAED    AJREG4                         $
         TIXZ    0,4
         TMA     C/HLT,0:C/TIJL,AJSRFWD         $
         JMP     XSRCH                          $
         JAZ     FNERR
         TMQ     AJFNTAB+6                      $
         SLAQ    42                             $
         SLA     30                             $
         SLAQ    6                              $
         TAM     11,6                           $
         TIXZ    1,4                            $
         TMQ     6/1T47                         $
         ETA     11,6                           $
         TMD     0/47T47                        $
         JAED    CONVP                          $
         TMD     0/30T47                        $
         JAED    CONVH                          $
         JMP     FNERR                          $
CONVP    TMA     AJFNTAB+3                      $
         TMQ     AJFNTAB                        $
         JAGQF   AJREG3                         $
         TQM     AJFNTAB+3                      $
         TAM     AJFNTAB                        $
         TMA     AJFNTAB+1                      $
         TMD     AJFNTAB+4                      $
         TDM     AJFNTAB+1                      $
         TAM     AJFNTAB+4                      $
         TMA     AJFNTAB+2                      $
         TMD     AJFNTAB+5                      $
         TDM     AJFNTAB+2                      $
         TAM     AJFNTAB+5                      $
AJREG3   TMA     AJFNTAB                        $
         TMQ     AJFNTAB+1                      $
         JMP     COMPL                          $
         TDM     3,6                            $
         TQM     4,6                            $
         TAM     5,6                            $
         TMA     AJFNTAB+3                      $
         TMQ     AJFNTAB+4                      $
         JMP     COMPL                          $
         TDM     6,6                            $
         TQM     7,6                            $
         TAM     8,6                            $
         TMQ     3,6                            $
         FMMR    6,6                            $
```

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```
         TMQ     4,6                            $
         FMAD    7,6                            $
         TMQ     5,6                            $
         FMAD    8,6                            $
         TAM     LDOTL                          $
         FCAMA   LDOTL                          $
         FSM     F/.9998477                     $
         TIXZ    2,4                            $
         JAP     FNERR                          $
S        FACOS   LDOTL                          $

         TAM     10,6                           $
         TMQ     LDOTL                          $
         FMMR    LDOTL                          $
         TMQ     F/1                            $
         FMSU    F/1                            $
S        FSQRT                                  $

         TAM     2,6                            $
         TMQ     5,6                            $
         FMMR    7,6                            $
         TMQ     4,6                            $
         FMSU    8,6                            $
         FDA     2,6                            $
         TQM     0,6                            $
         TMQ     3,6                            $
         FMMR    8,6                            $
         TMQ     5,6                            $
         FMSU    6,6                            $
         FDA     2,6                            $
         TQM     1,6                            $
         TMQ     4,6                            $
         FMMR    6,6                            $
         TMQ     3,6                            $
         FMSU    7,6                            $
         FDAS    2,6                            $
         JMP     CONVOUT                        $
CONVH    TIXZ    4,4                            $
         TMQ     AJFNTAB                        $
         TMA     F/89                           $
         JAGQF   (P)+2H                         $
         JMP     FNERR                          $
         FMMR    DE2RA                          $
         TAM     AJFNTAB                        $
S        FSIN                                   $

         TAM     5,6                            $
S        FCOS    AJFNTAB                        $

         TAM     6,6                            $
         TIXZ    5,4                            $
         TMA     AJFNTAB+1                      $
         TMQ     AJFNTAB+4                      $
```

```
        JAEQ    FNERR                        $
        TQM     1,6                          $
        TMQ     DE2RA                        $
        FMARS   0,6                          $
        FMMRS   1,6                          $
        FSM     0,6                          $
        JAP     (P)+2H                       $
        FAM     TWOPI                        $
        TAM     10,6                         $
CONVOUTTMA      AJFNTAB+2                    $
        TIXZ    3,4                          $
        TMQ     F/0                          $
        JAEG    FNERR                        $
        TAM     9,6                          $
        TMA     AJFNTAB+5                    $
        JAEQ    FNERR                        $
        FSM     9,6                          $
        FDAS    10,6                         $
        TMQ     ERPKM                        $
        FMMRS   9,6                          $
        FMMRS   10,6                         $
*                                            $
        TMD     11,6                         $
STIKFN  TDM     (P)                          $
        TMA     FNCONT                       $
        SLA     10                           $
        TMQ     42/1T47                      $
        EIS     11,6                         $
        INCA    STIKFN                       $
        INCA    FNCONT                       $
        AIXO    12,6                         $
        AIXO    1,5                          $
AJREG4  AIXO    5,3                          $
        TMA     FNFLG                        $
        JAZ     4A21                         $
        CM      FNFLG                        $
        JMP     AJREG2                       $
COMPL   TJM     COMPLX                       $
        TQM     TEMP2                        $
        TMQ     DE2RA                        $
        FMARS   TEMP1                        $
        FMMRS   TEMP2                        $
S       FCOS                                 $

        TAM     TEMP3                        $
S       FSIN    TEMP2                        $


        TAM     TEMP2                        $
S       FCOS    TEMP1                        $


        TAQ                                  $
        FMMR    TEMP2                        $
        TAM     TEMP2                        $
```



```
        FCSM    TEMP3                        $
        FMARS   TEMP3                        $
S       FSIN    TEMP1                        $


        TMQ     TEMP2                        $
        TMD     TEMP3                        $
COMPLX  JMP     (P)                          $
DOTPR   TDM     TEMP6                        $
        TJM     DOTPRX                       $
        TAM     TEMP4                        $
        FMMR    TEMP2                        $
        TMQ     TEMP4                        $
        FMAD    TEMP1                        $
        TMQ     TEMP6                        $
        FMAD    TEMP3                        $
DOTPRX  JMP     (P)                          $
FNERR   TJM     FNERRX                       $
        TAM     TEMP1                        $
        TMA     0/3T15                       $
        CD                                   $
        TXDLC   ,4                           $
        JAED    (P)+2H                       $
        JMP     (P)+3H                       $
        TMA     RCPTST                       $
        JAZ     FNERRX-1H                    $
        TMA     C/HLT,5;C/HLT,FNCOM6         $
        JMP     PANT                         $
        TMA     N/5T15                       $
        TXDRC   ,3                           $
        JMP     PANT                         $
        TMD     P/FNCOM-1,T39                $
        ADXR    ,4                           $
        TMA     ,4                           $
        JMP     PANT                         $
        JMP     PANT.SPACE                   $
        JMP     AJREG4                       $
        TMA     TEMP1                        $
FNERRX  JMP     (P)                          $

L       HLT     7                            $
        HLT     AJERR7
L FNCOM HLT     3                            $
        HLT     FNCOM1                       $
        HLT     4                            $
        HLT     FNCOM2                       $
        HLT     3                            $
        HLT     TRCOM5                       $
        HLT     4                            $
        HLT     FNCOM4                       $
        HLT     3                            $
        HLT     FNCOM5                       $
FNCOM1  A/FAN TYPE NOT H OR P$               $
```

```
 FNCOM2 A/FAN ENDS TOO CLOSE TO COLINEARS $


 FNCOM4 A/ELEVATION GREATER THAN 89 DEGS  $


 FNCOM5 A/AZIMUTH LIMITS ARE EQUALS       $


 FNCOM6 A/ERROR IN FAN RECORD, RECORD REJECTEDS


L AJSRFWDICOZ     6*128+6                 $
        TMA     AJFNTAB                   $
        ICOZ    12*128+6                  $
        TMA     AJFNTAB+1                 $
        ICOZ    18*128+6                  $
        TMA     AJFNTAB+2                 $
        ICOZ    24*128+6                  $
        TMA     AJFNTAB+3                 $
        ICOZ    30*128+6                  $
        TMA     AJFNTAB+4                 $
        ICOZ    36*128+6                  $
        TMA     AJFNTAB+5                 $
        HLT     39*128+3                  $
        CAM     AJFNTAB+6                 $
  AJ79F W/       FS
  AJERR1 A/FAN PARAMETER (REQUEST) CARD MISSING (NO R IN COS



        A/L 79).S
  AJERR2 A/NO FAN CARDS AND NO MAX. ELEV. REQUESTS


  AJERR3 A/ADDRESS CARD MISSINGS 3


  AJERR4 A/PRIORITY NOT PUNCHED IN PARAMETER (REQUEST) CARD.S



  AJERR5 A/MORE THAN THIRTY RECORDS IN F TYPE CARDSS
```



```
 AJERR6 A/ILLEGAL CARD EXISTS AFTER F CARDS.S


 AJERR7 A/CHECK INPUT DATA FOR ILLEGAL CHARACTERS IN FIELDS.S



 AJERR9 A/STA.NO.ON R AND F CARDS DIFFER.S


 AJERR10A/ALL, ALL BUT, OR ONLY CARDS MISSINGS5


 AJERR11A/ROUTING DATA MISSINGS 3


 AJERR12A/TOO MANY ROUTE CARDS $ 3


 AJSRFWRHLT     4*128+4                 $
        TMA     STAN                    $
        ICOZ    12*128+7                $
        TMA     BEGT                    $
        ICOZ    19*128+7                $
        TMA     ENDT                    $
        ICOZ    29*128+4                $
        TMA     BEAMW                   $
        HLT     33*128+4                $
        TMA     YEAR                    $
        JBT     34*128+1                $
        TMA     ELFLAG                  $
        JBT     35*128+1                $
        TMA     RNGFLAG                 $
        JBT     37*128+1                $
        TMA     CLSFY                   $
        HLT     39*128+2                $
        TMA     PRIO                    $
        JBT     41*128+1                $
        TMA     VPASS                   $
        JBT     43*128+1                $
        TMA     DPASS                   $
        JBT     45*128+1                $
        TMA     FNCPA                    $
        JBT     47*128+1                $
```

```
        TMA     RCPTST                    S
        JBT     49*128+1                  S
        TMA     CONTG                     S
        JBT     57*128+1                  S
        TMA     DRCOSFL                   S
        ICOZ    64*128+7                  S
        TMA     ZFX                       S
        ICOZ    71*128+7                  S
        TMA     ZFY                       S
           JBT  72*128+1   S
        TMA     4C4+2    S
AJSRFWLHLT      79*128+1                  S
        CAM     AJCOL79                   S
AJSRFWEICOZ     6*128+6                   S
        CAM     AJFNTAB                   S
TIMEOUTTJM      TIMEX                     S
        TMA     F/29                      S
        FAM     BEGT                      S
        TAM     ENDT                      S
        JMP     FYKLOK                    S
        TQM     TEMP0                     S
        TMA     C/HLT,0;C/TIJL,TIMO1      S
        JMP     GLOP.GLOP                 S
TIMEX   JMP     (P)                       S

L TIMO1 HLT     69*128+51                 S
        TMA     TIMO2                     S
        ICOZ    77*128+3                  S
        CAM     TEMP0                     S
TIMO2   A/REQUESTED TIME EXCEEDS 29 DAYS. END TIME CHANGED TOS




CHKMEL  TMA     FNCPA                     S
        JAZ     (P)+4H                    S
        TMD     F/0                       S
        TDM     FANTAB+5                  S
        JMP     LOAD A1-3H                S
        TMA     C/HLT,5;C/HLT,AJERR2      S
        JMP     AJERROR+5H                S

MASKBL  W/                                S
MASKSATO/777777T47                        S
MASK1   1/1TO                             S
MASK2   W/0000ZZZZ                        S
                                          S
AJFNTABASTOR    7                         S
AJBFFR  W/                                S
        SET     (P)+150                   S
FNOTAB  SET     (P)+30                    S
        W/**                              S
        W/T                               S
```



```
OCTALA SET      (P)+50                    S
TEMP0   S                                 S
TEMP1   S                                 S
TEMP2   S                                 S
TEMP3   S                                 S
TEMP4   S                                 S
TEMP5   S                                 S
TEMP6   S                                 S
TEMP7   S                                 S
TEMP8   S                                 S
TEMP9   S                                 S
TEMP10  S                                 S
BUF1                                      S
BUF2                                      S
BUF3                                      S
BUF4                                      S
BUF5                                      S
BUF6                                      S
BUF7                                      S
BUF8                                      S
XLSUNT                                    S
ALSUN                                     S
CSALS                                     S
SNALS                                     S
DLSUN                                     S
CPT                                       S
SNDLS                                     S
CSDLS                                     S
SUNLX                                     S
SUNLY                                     S
SUNLZ                                     S
SNHSN                                     S
CSHSN                                     S
CSAN                                      S
HSUN                                      S
CSPST                                     S
SAVE    S
STYPE   S
STNM    S
STNM2   S
PHIRD   S
XLAMBA  S
OALT    S
XOVCT   S
CAPZ    S
STGAR   S
STAID   S
AJFNFLDS
AJCAPRQS
RMAX    S
BEAMW   S
XINTRV  S
AJSVXR1S
AJSV34  S
AJSV56  S
```

```
AJSV7   $
AJPAGES$
AJTYSW  $
AJSMDAY$
AJHR    $
AJMIN   $
AJFRMIN$
AJSAT   $
AJAZ    $
AJREV   $
AJRANGE$
AJRRATE$
AJELEV  $
AJDEPRE$
AJDAY   $
AJDDD   $
AJDATE  $
AJTM17  $
AJMSGNO$
ZULUT   $
TFN     $
MONTH   $
DFN     $
AJCOL79$
YEAR    $
FDAY    $
BEGT    $
ENDT    $
PRIO    $
AJ1STF  $
CLSFY   $
CLAS    $
AJSSAVE$
AJSTAID$
AJFLGIT$
AJSVSV  $
AJCKEND$
BASE    $
VPASS   $
DPASS   $
FCAP    $
RCPTST  $
CONTG   $
STAN    $
AJSTAN  $
AJKPXR3$
ELFLAG  $
RNFLAG  $
AJHOLD  $
AJCNV1  $
AJCNV2  $
AJNMBLK$
AJSTBK  $
AJCMNBK$
AJDNCNT$
```



```
AJHRGSWS
4LMAX        $        $
4LMAX2       $        $
4RMAX        $        $
IEEND        $        $
ILOCE        $        $
IRSET        $        $
NOELM        $        $
PHAIN        $        $
PSATN        $        $
AJFAN        $        $
AJSAT1       $        $
ATYPE        $        $
SINHMIN      $        $
COSHMIN      $        $
TRDELT       $        $
TRFLG        $        $
PPP          $        $
TRTYPE       $        $
XL1X         $        $
XL1Y         $        $
XL1Z         $        $
XL2X         $        $
XL2Y         $        $
XL2Z         $        $
A1H          $        $
A2H          $        $
SINHREF      $        $
COSHREF      $        $
RHOMAX       $        $
RHODMAX      $        $
DRCOSFL      $        $
FANNO        $        $
FNCONT       $        $
FNFLG        $        $
UMAXT        $        $
RT1MUS       $        $
VMAXT        $        $
RT1MVS       $        $
CCPHTH       $        $
CDEL         $        $
CNMT         $        $
COSPSI       $        $
CPSI         $        $
CSPHTH       $        $
DT           $        $
EPOCHM       $        $
EPS          $        $
EPSLN        $        $
ERR          $        $
FNCPA        $        $
K1           $        $
LDOTL        $        $
LSTT         $        $
MARG         $        $
```

```
N                                                         $            $
OBSAZ                                                     $            $
OBSEL                                                     $            $
OBSRR                                                     $            $
OLD ONE                                                   $            $
PAR1                                                      $            $
PAR2                                                      $            $
PAR3                                                      $            $
PAR4                                                      $            $
Q2                                                        $            $
RHO                                                       $            $
RHODDOT                                                   $            $
RHODOT                                                    $            $
RHODOTN                                                   $            $
RHOSQRD                                                   $            $
RHOXH                                                     $            $
RHOYH                                                     $            $
RHOZH                                                     $            $
RSU                                                       $            $
RSV                                                       $            $
RSW                                                       $            $
SDEL                                                      $            $
SINPSI                                                    $            $
SNMT                                                      $            $
SPCI                                                      $            $
STST                                                      $            $
T1                                                        $            $
T2                                                        $            $
TEM1                                                      $            $
TF                                                        $            $
THTAO                                                     $            $
THTAI                                                     $            $
TI                                                        $            $
VISIBLE                                                   $            $
XFX                                                       $            $
XFY                                                       $            $
XFZ                                                       $            $
YFX                                                       $            $
YFY                                                       $            $
YFZ                                                       $            $
ZFX                                                       $            $
ZFY                                                       $            $
ZFZ                                                       $            $
XILLUM                                                    $            $
XNXH                                                      $            $
XNYH                                                      $            $
XNZH                                                      $            $
ZDOTW                                                     $            $
SATCONT                                                   $            $
```



```
* * * * * MAIN PROGRAM STARTS HERE * * * *  *
 START1  CM     PHAIN                       $ ERROR EXIT RETURNS TO NXCASE
         JMP    INITEL                      $
         JMP    SINIT                       $
 NXTEL   TMD    F/1                         $ SET ERROR EXIT TO RETURN
         TDM    PHAIN                       $ TO NXTEL.
         TMA    C/HLT,SATNOS                $ GET NEXT SATELLITE TO BE
         AM     SATCONT                     $ PROCESSED FROM SATNOS TABLE.
         TAD                                $
         TDXLC  ,0                          $
 NXTEL1  TMA    0/1T15                      $
         AMS    SATCONT                     $
         AIXO   1,0                         $
         TMQ    1/1T0                       $
         ETA    0,0                         $
         JAN    NXTEL2                      $
         TMA    0,0                         $
         JAZ    AJENDPK                     $ ALL SATELLITES DONE
         JMP    NXTEL1                      $
 NXTEL2  TMQ    MASKSAT                     $
         ETA    0,0                         $
         JAZ    AJENDPK                     $ ALL SATELLITES DONE
         TAM    SATN                        $
         JMP    NXTELM                      $ UNPACK ELEMENT SET
         JMP    NXTEL1                      $ IF SATELLITE NOT FOUND
         JMP    EINIT                       $ INITIALIZE FOR SATELLITE
         TMQ    XNO                         $
         TMA    F/.072220521                $
         JAGQF  (P)+4H                      $ SATELLITE NOT IN DECAY
         TMD    1/1T1                       $
         DORMS  0,0                         $ IR5 MUST BE PRESERVED
         JMP    NXTEL1                      $ SATELLITE IN DECAY
         TMA    EPOCH                       $
         FSM    ENDT                        $
         TMQ    F/-100                      $
         JAGQF  (P)+3H                      $
         TMD    1/1T2                       $
         DORMS  0,0                         $
 START2  TMD    F/3                         $
         TDM    PHAIN                       $
         JMP    NXPASS                      $
         JMP    NXTEL                       $ NO MORE PASSES
         TMQ    RHO                         $
         FMMR   EPSLN                       $
         FMSU   FANTAB+5                    $
         TMQ    RHOZH                       $
         JAGQF  START2                      $ SATELLITE CANNOT BE SEEN.
         TMA    FNCPA                       $
         JAZ    (P)+5H                      $
         JMP    RHARR                       $ FIXED FANS BEING PROCESSED
         TMD    0/36 T5
         TDM    FANNO
         JMP    STORE                       $ AND CPA REQUESTED.
         JMP    AINIT                       $ INITIALIZE NXACQ ROUTINE
 START3  TMD    F/2                         $ SET ERROR EXIT TO RETURN
```

```
        TDM     PHAIN                   $ TO START3.
        JMP     NXACQ                   $ GET NEXT ACQUISITION MODEL
        JMP     (P)+2H                  $ NO MORE ACQ. MODELS
        JMP     START4                  $ NORMAL RETURN FROM NXACQ
        JMP     ENDPK                   $ FINISH UP THIS PASS
        TMD     F/1                     $ SET ERROR EXIT TO RETURN
        TDM     PHAIN                   $ TO NXTEL.
        JMP     START2                  $ GO BACK AND GET NEXT PASS.
*
 START4 JMP     AQUIRE                  $ PROCESS ACQ. MODEL
        JMP     START3                  $ GO BACK AND GET NEXT ONE.
*
*  * * * *  MAIN PROGRAM ENDS HERE  * * * *  *
```



```
        AFEND   42$
HACQUI  TJM     HACQUIX
        CM      PAR4                    SET PAR4=0
        FCSM    EPSLN                   TEST IS RHO(SIN(HREF)-EPSLN*
        TMQ     COSHREF                         COS(HREF)) GREATER THAN OR
        FMAR                                    EQUAL TO RHOZH
        FAM     SINHREF
        TMQ     RHO
        FMAR
        TMQ     RHOZH
        JAGQF   HACQUIX
        TMD     TI                       SET PAR 2=TI
        TDM     PAR2
        TMD     F/-10.0                  SET  DT=-10
        TDM     DT
HACQ3   TMQ     RHO                     TEST IS RHO*EPSLN*COSHREG  GREATER
        FMMR    SINHREF                    THAN OR = ABS( RHOZH-RHO* SINHREF)
        FSM     RHOZH
        TAQ
        FCAQAS  TEMP1                     TEMP1=ABS(RHOZH-RHO*SINHREF)
        TMQ     RHO
        FMMR    EPSLN
        TMQ     COSHREF
        FMAR
        TMQ     TEMP1
        JAGQF   HACQ1
HACQ8   TMA     F/1.0$
        TAM     PAR3
        TMA     DT                       SET TI=TI+DT
        FAMS    TI
        JMP     CRHOB                    SUBROUTINE
        TMQ     RHO                      TEST IF  RHO*SINHREF  IS GREATER
        FMMR    SINHREF                     THAN OR =  RHOXH
        TMQ     RHOZH
        JAGQF   HACQ2
        JMP     HACQ3
HACQ2   TMQ     DT                      DT = SIGN OF PAR3(RHOZH-RHO*SINHREF)
        TMA     F/.5
        FMARS   TEMP1                      TEMP1= DT*.5
        TMQ     RHO
        FMMR    SINHREF
        FSM     RHOZH
        TAM     TEMP2                      TEMP2= RHO*SINHREF - RHOZH
        TMQ     PAR3
        FMAR
        TMQ     TEMP1
        JAN     HACQ4
        FCSQ
        TAQ
HACQ4   TQM     DT                      DT
        FCSM    TEMP2                    SET PAR3= RHOZH- RHO*SINHREF
        TAM     PAR3
        TQA                              SET  TI=TI+DT
        FAMS    TI
        JMP     CRHOB
```

```
         TMQ      RHO                  TEST IF RHO*EPSLN*COSHREF > OR =
         FMMR     SINHREF                ABS(RHOZH-RHO*SINHREF)
         FSM      RHOZH
         TAQ
         FCAQAS   TEMP1                TEMP1=ABS(RHOZH-RHO*SINHREF)
         TMQ      RHO
         FMMR     EPSLN
         TMQ      COSHREF
         FMAR
         TMQ      TEMP1
         JAGQF    HACQ1
         JMP      HACQ2
HACQ1    JMP      RHARR                SUBROUTINE
         TMA      ATYPES  TEST FOR TRACKER TYPE
         TMD      W/0000000TS
         JAED     HACQ1KS
         JMP      AFILT2               SUBROUTINE
         JMP      HACQ6                  EXIT -FAILED ANGLE TESTS
         JMP      RFILT2               SUBROUTINE
         JMP      HACQ6                  EXIT -FAILED RANGE TEST
HACQ1K   JMP      STORES
         TMA      F/1.0
         FAMS     PAR4
HACQ6    TMA      TI                   TEST IF  TI >OR= PAR2
         TMQ      PAR2
         JAGQF    HACQ7
         TAM      T1                   SET T1=TI
         TMD      F/10.0               SET DT=10
         TDM      DT
         TQM      TI                   SET  TI=PAR2
         JMP      HACQ8
HACQ7    TAM      T2                   SET T2=TI
         TMD      PAR2
         TDM      TI
HACQUIXJMP        0                    EXIT


AFILT2   TJM      AFILT2X
         TMA      A2H                  TEST IF (A2H-A1H)(OBSAZ-A1H)
         FSM      A1H                          (A2H-OBSAZ) 7 OR=  0
         TAM      TEMP1
         TMA      OBSAZ
         FSM      A1H
         TAQ
         TMA      A2H
         FSM      OBSAZ
         FMAR
         TMQ      TEMP1
         FMAR
         JAN      AFILT2X
         TMA      D/1B16               INCREMENT RETURN ADDRESS FOR
         AMS      AFILT2X                NORMAL RETURN
```



```
L AFILT2XJMP      0                    EXIT


RFILT2   TJM      RFILT2X
         TMA      RCPTST               TEST IS RCPTST=0
         JAZ      RFB1
         TMA      OBSAZ                TEST IF RHO > OR= RHOMAX+
         FSM      A1H                      RHODMAX*(OBSAZ-A1H)
         TMQ      RHODMAX
         FMAR
         FAM      RHOMAX
         TAQ
         TMA      RHO
         JAGQF    RFILT2X
RFB1     TMA      D/1 B16              INCREMENT BY  1H
         AMS      RFILT2X
L RFILT2XJMP      0                    EXIT


AQUIRE   TJM      ACQUIRX              SAVE RETURN ADDRESS
         TMA      ATYPE                TEST IF ATYPE IS P(PLANAR FAN),
         TMD      A/0000000PS          H(HORIZONTAL FAN),OR T(TRACKER)
         JAED     ACQUI1                 PLANAR FAN
         TMD      A/0000000HS
         JAED     ACQUI2                HORIZONTAL FAN
         TMD      A/0000000TS
         JAED     ACQUI3
         HLT                           ERROR
ACQUI3   JMP      TACQUI                  TRACKER  SUBROUTINE
ACQUIRXJMP                             EXIT
ACQUI1   JMP      PACQUI                 PLANAR SUBROUITNE
         JMP      ACQUIRX
ACQUI2   JMP      HACQUI                 HORIZONTAL SUBROUTINE
         JMP      ACQUIRX


PACQUI   TJM      PACQUIX
         JMP      PACRHDN              SUBROUTINE COMPUTES RHO DOT N
         TAM      PAR1
         TMD      TI                    PAR2=TI
         TDM      PAR2
         CM       PAR4                  PAR4=0
         TMA      XL1Z                 TEST IS RHO(XL1Z-EPSLN) GRRATER
         FSM      EPSLN                     THAN OR EQUAL TO RHOZH
         TMQ      RHO
         FMAR
```

```
         TMQ     RHOZH
         JAGQF   PACQUIX
         TMD     F/-10.0          SET DT= -10
         TDM     DT
PACQ2    TMA     RHOZH            TEST IF RHOZH IS POSITIVE
         JAP     PACQ1
PACQ6    TMA     TI               TEST IF TI IS GREATER THAN OR EQUAL
         TMQ     PAR2                 TO PAR2
         JAGQF   PACQ13
         TMD     PAR1S
         TDM     RHODOTNS
         TQM     TI               SET  TI= PAR2
         TMD     F/10.0           SET  DT=+10
         TDM     DT
PACQ8    TMA     DT               SET TI= TI+DT
         FAMS    TI
         TMD     RHODOTN          SET  PAR3= RHODOTN
         TDM     PAR3
         JMP     CRHOB            SUBROUTINE
         JMP     PACRHDN          SUBROUTINE COMPUTES RHO DOT N
         TMQ     PAR1             TEST IF PAR1* RHODOTN IS POSITIVE
         FMAR
         JAP     PACQ2
PACQ5    TMQ     DT               COMPUTE DT= SIGN(PAR3,RHODOTN)*DT/2
         FMMR    F/.5
         TAM     TEMP1            TEMP1= DT/2
         TMQ     PAR3
         FMMR    RHODOTN
         TMQ     TEMP1
         JAP     PACQ3
         FCSQ
         TAQ
PACQ3    TQM     DT
         TQA                      SET TI= TI+DT
         FAMS    TI
         TMD     RHODOTN          SET  PAR3= RHODOTN
         TDM     PAR3
         JMP     CRHOB            SUBROUTINE
         JMP     PACRHDN          SUBROUTINE COMPUTES RHO DOTN
         TAQ                      TEST IF RHO*EPSLN IS GREATER THAN OR
         FCAQAS  TEMP1              EQUAL TOABS(RHODOTN) = TEMP1
         TMQ     RHO
         FMMR    EPSLN
         TMQ     TEMP1              TEMP= ABS(RHODOTN)
         JAGQF   PACQ4
         JMP     PACQ5
PACQ4    JMP     AFILT1           SUBR. TEST ANGULAR LIMITS OF FAN
         JMP     PACQ6                TEST FAILED
         JMP     RFILT1           SUBR.  TEST RANGE LIMITS OF FAN
         JMP     PACQ6                 TEST FAILED
         JMP     RHARR            SUBR. COMPUTES RHO,H,A,S RHODOT
         JMP     STORE            SUBR. STORE PT FOR OUTPUT AFTER TESTIN
         TMA     F/1.0
         FAMS    PAR4
         JMP     PACQ6
```



```
PACQ1    FCAMA   RHODOTN          TEST IF RHO*EPSLN IS GREATER THAN OR
         TAM     TEMP1              EQUAL TO ABS(RHODOTN)
         TMQ     RHO
         FMMR    EPSLN
         TMQ     TEMP1              TEMP1= ABS(RHODOTN)
         JAGQF   PACQ4
         JMP     PACQ8
PACQ13   TMD     PAR2
         TDM     TI
PACQUIXJMP       0                EXIT
PACRHDNTJM       PACRHDX          COMPUTE RHO DOT N
         TMQ     RHOXH
         FMMR    XNXH
         TMQ     RHOYH
         FMAD    XNYH
         TMQ     RHOZH
         FMAD    XNZH
         TAM     RHODOTN
PACRHDXJMP       0


AFILT1   TJM     AFILT1X
         TMA     RHOZH
         JAN     AFILT1X
         TMQ     RHOZH            TEST IF (L1 CROSSL) DOT(L CROSSL2)
         FMMR    XL2Y                 IS POSITIVE
         TMQ     RHOYH              QTY  TO BE TESTED =((XL2Z*RHOYH-
         FMSU    XL2Z                XL2Y*RHOZH)*(XL1Y*RHOZH-XL1Z*RHOYH)
         TAM     TEMP1               +(XL2Z*RHOXH-XL2X*RHOZH)*(XL1X*
         FMMR    XL1Z                RHOZH-ZL1Z*RHOXH)+(XL2Y*RHOXH
         TMQ     RHOZH               -XL2X*RHOYH)*(XL1X*RHOYH
         FMSU    XL1Y                -XL1Y*RHOXH))/RHO**2
         TAM     TEMP2
         FMMR    XL2X
         TMQ     RHOXH
         FMSU    XL2Z
         TAM     TEMP3
         FMMR    XL1Z
         TMQ     XL1X
         FMSU    RHOZH
         TAM     TEMP4
         FMMR    RHOYH
         TMQ     RHOXH
         FMSU    XL1Y
         TAM     TEMP5
         FMMR    XL2Y
         TMQ     XL2X
         FMSU    RHOYH
         TMQ     TEMP5
         FMAR
         TMQ     TEMP4
         FMAD    TEMP3
```

```
         TMQ      TEMP2
         FMAD     TEMP1
         JAN      AFILT1X
         TMA      D/1816
         AMS      AFILT1X
L AFILT1XJMP      0



  RFILT1 TJM      RFILT1X
         TMA      RCPTST           TEST IF RCPTST=0
         JAZ      RFA1
         TMQ      RHOXH            TEST IF RHO IS GREATER THAN OR EQUAL T
         FMMR     XL1X                RHOMAX+RHODMAX*ARCOS(L DOT L1)
         TMQ      RHOYH
         FMAD     XL1Y
         TMQ      RHOZH
         FMAD     XL1Z
         FDA      RHO
         TQA
S        FACOS
         TMQ      RHODMAX
         FMAR                                $
         FAM      RHOMAX                     $
         TAQ
         TMA      RHO                        $
         JAGQF    RFILT1X
  RFA1   TMA      D/1816
         AMS      RFILT1X
L RFILT1XJMP      0                EXIT



  AINIT  TJM      AINITX
         TMD      RHO               SAVE RHO,RHOXH,RHOYH,RHOZH,
         TDM      BUFFER                 + OBSRR
         TMD      RHOXH
         TDM      BUFFER+1
         TMD      RHOYH
         TDM      BUFFER+2
         TMD      RHOZH
         TDM      BUFFER+3
         TMD      OBSRR
         TDM      BUFFER+4
         TMD      TI                         $
         TDM      BUFFER+5                   $
         TIJ      FANTAB
         TJM      IRSET
  AINITX JMP      0
```



```
BUFFER ASTOR   6                             $


NXACQ  TJM     NXACQX
       TMD     BUFFER               RESTORE  RHO, RHOXH, RHOYH, RHOZH,
       TDM     RHO                     + OBSRR
       TMD     BUFFER+1
       TDM     RHOXH
       TMD     BUFFER+2
       TDM     RHOYH
       TMD     BUFFER+3
       TDM     RHOZH
       TMD     BUFFER+4
       TDM     OBSRR
       TMD     BUFFER+5                      $
       TDM     TI                            $
       TMD     IRSET
       TDXLC   ,1                   X1=L/FANTAB   STORED IN IRSET
       TMA     A/ZZZZZZZZ$
       TMD     ,1
       JAED    NXACQX
       TMQ     0/77T47              TEST FOR RECORD TYPE
       ETA     11,1
       TMD     A/0000000P$
       JAED    NXAP1
       TMD     A/0000000H$
       JAED    NXAH1
       TMD     A/0000000T$
       JAED    NXAT1
       HLT     0
NXAP1  TDM     ATYPE
       TMD     ,1
       TDM     XNXH
       TMD     1,1
       TDM     XNYH
       TMD     2,1
       TDM     XNZH
       TMD     3,1
       TDM     XL1X
       TMD     4,1
       TDM     XL1Y
       TMD     5,1
       TDM     XL1Z
       TMD     6,1
       TDM     XL2X
       TMD     7,1
       TDM     XL2Y
       TMD     8,1
       TDM     XL2Z
NXAH2  TMD     10,1
       TDM     RHODMAX
NXAT2  TMQ     0/77T5                        $
```

```
         ETA      11,1S
         TAM      FANNO
         TMD      9,1                  S
         TDM      RHOMAX
         TMA      D/1816
         AMS      NXACOX
         TMA      N/12T15
         AMS      IRSET
L NXACOX JMP      0
  NXAH1  TDM      ATYPE
         TMD      ,1
         TDM      A1H
         TMD      1,1
         TDM      A2H
         TMD      5,1
         TDM      SINHREF
         TMD      6,1
         TDM      COSHREF
         JMP      NXAH2
  NXAT1  TDM      ATYPE
         TMD      ,1
         TDM      UMAXT
         TMD      1,1
         TDM      VMAXT
         TMD      2,1
         TDM      COSPSI
         TMD      3,1
         TDM      RT1MUS
         TMD      4,1
         TDM      RT1MVS
         TMD      5,1
         TDM      SINHMIN
         TDM      SINHREFS
         TMD      6,1
         TDM      COSHMIN
         TDM      COSHREFS
         TMD      7,1
         TDM      PPP
         TMD      8,1
         TDM      TRDELT
         TMD      10,1
         TDM      TRTYPE
         JMP      NXAT2


  TACOJI1TJM      TCQUIX
         TMD      F/1.0               SET PAR1= 1.0
         TDM      PAR1
         JMP      AFILT3              SUBROUTINE
         JMP      TCQ1                  FAILED EXIT
         JMP      TCQ2                  MARGINAL EXIT
  TCQ6   TMD      TI                    NORMAL OR PASS EXIT     SET PAR2=TI
```

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```
         TDM      PAR2
         TMD      F/1.0               SET PAR3=1.0
         TDM      PAR3
         TMD      F/-10,0             SET DT=-10.0
         TDM      DT
  TCQ3   TMA      DT                   SET TI=TI+DT
         FAMS     TI
         JMP      CRHOB               SUBROUTINE
         JMP      AFILT3              SUBROUTINE
         JMP      TCQ4                  FAILED EXIT
         JMP      TCQ5                  MARGINAL EXIT
         JMP      TCQ3                  PASSED EXIT
  TCQ2   TMA      VISIBLE             TEST FOR VISIBILITY YES =X NO=0
         JAZ      TCQ1                   FAILS
         JMP      TCQ6                   OK
  TCQ1   TMD      F/-1.0              SET PAR1=-1.0
         TDM      PAR1
         TDM      PAR3                SET PAR3=-1.0
         TMD      TI                  SET PAR2=TI
         TDM      PAR2
         TMD      F/-.2                SET DT=-.2
         TDM      DT
  TCQ7   TMA      DT                  SET TI=TI+DT
         FAMS     TI
         JMP      CRHOB               SUBROUTINE
         TMA      F/0.0               TEST IS /> OR=RHOZH
         TMQ      RHOZH
         JAGQF    TCQ8
         JMP      AFILT3              SUBROUTINE
         JMP      TCQ7                   FAILED EXIT
         JMP      TCQ9                  MARGINAL EXIT
         TMD      TI                  SET PAR2=TI
         TDM      PAR2
  TCQ10  TMQ      PAR3                SET DT=PAR3*DT*.5
         FMMR     DT
         TMQ      F/.5
         FMARS    DT
         TMD      F/1.0               SET PAR3=1.0
         TDM      PAR3
  TCQ11  TMA      DT                  SET TI=IT+DT
         FAMS     TI
         JMP      CRHOB               SUBROUTINE
         JMP      AFILT3              SUBROUTINE
         JMP      TCQ4                  FAILED EXIT
         JMP      TCQ5                  MARGINAL EXIT
         JMP      TCQ10                  PASSED EXIT
  TCQ5   JMP      RHARR               SUBROUTINE
         JMP      STORE               SUBROUTINE
         TMA      F/1.0               SET PAR4=PAR4+1.0
         FAMS     PAR4
         TMD      F/2.0               TEST IF PAR4=2.0
         JAED     TCQ12
         TMD      TI                  SET T1=TI
         TDM      T1
         TMD      F/1.0                SET PAR3=1.0
```

```
        TDM     PAR3
        TMA     PAR1          SET DT=PAR1*10
        TMQ     F/10.0
        FMARS   DT
        TMD     PAR2          SET TI=PAR2
        TDM     TI
        JMP     TCQ3
TCQ12   TMA     T1            TEST IS T1 > OR = TI
        TMQ     TI
        JAGQF   TCQ13
        TMD     TI            SET T2=TI
        TDM     T2
TCQUIX  JMP     0             EXIT
TCQ13   TMD     T1            SET T2,T1
        TDM     T2
        TMD     TI            SET T1=TI
        TDM     T1
        JMP     TCQUIX
TCQ4    TMQ     PAR3          SET DT=-PAR3*DT*.5
        FMMR    DT
        TMQ     F/-.5
        FMARS   DT
        TMD     F/-1.0        SET PAR3=-1.0
        TDM     PAR3
        JMP     TCQ11
TCQ9    TMD     TI            SET PAR2=TI
        TDM     PAR2
        JMP     TCQ5
TCQ8    TMA     TI            TEST IS TI > OR = PAR2
        TMQ     PAR2
        JAGQF   TCQUIX
        TQM     TI            SET TI=PAR2
        TMD     F/.2          SET DT=.2
        TDM     DT
        TMD     F/1.0         SET PAR1=1.0
        TDM     PAR1
        JMP     TCQ7


TACQUI  TJM     TACQUIX
        CM      PAR4          SET PAR4=0
        TMA     RCPTST        TEST TS RCPTST=ZERO
        JAZ     TACQ1
        TMA     RHOMAX        TEST IS RHOMAX >OR= RHO
        TMQ     RHO
        JAGQF   TACQ1
TACQUIXJMP      0
TACQ1   TMA     TRTYPE        TEST PHASED ARRAY TRTYPE=0 NO =1 YES
        JAZ     TACQ2
        JMP     TACQUI1       SUBROUTINE
TACQ3   TMA     F/1.0
        TMQ     PAR4
```



```
        JAGQF   TACQUIX
        TMA     PPP           TEST IF PPP=9.0
        TMD     F/9.0
        JAED    TACQ4
        JMP     TACQ6
TACQ4   TMA     TRDELT        N=INTERGRAL PART OF (T2-T1)/(2TRDELT)
        FAD
        TAM     TEMP1
        TMA     T2
        FSM     T1
        FDA     TEMP1
        TQA
        JMP     SEPSUB        SUBROUTINE FINDS INTEGRAL PART OF ACC
        TMQ     TRDELT
        FMARS   TI
        TMA     T2
        FAM     T1
        TMQ     F/.5
        FMAR
        FSMS    TI
        TMD     TRDELT        SET DT=TRDELT
        TDM     DT
        FCSM    DT            $
        FAMS    TI            $
TACQ4A  TMA     DPASS         $
        JAZ     TACQ7         $
        TMA     TRTYPE        $
        JAZ     (P)+2H        $
        JMP     TACQ7         $
        TMA     DT            $
        FAMS    T2            $
TACQ7   TMA     DT            SET TI=TI+DT
        FAMS    TI
        FSM     T2            TEST IF -1E-4 >OR = TI-T2
        TAQ
        TMA     F/-.00001
        JAGQF   TACQ8
        JMP     TACQUIX
TACQ8   JMP     CRHOB         SUBROUTINE
        JMP     RHARR         SUBROUTINE
        TMA     TRTYPE        TEST FOR PHASED ARRAY TRTYPE=0 NO 1YES
        JAZ     TACQ9
TACQ10  JMP     STORE         SUBROUTINE
        TMA     F/1.0
        FAMS    PAR4
        JMP     TACQ7
TACQ9   TMA     ELMAX         TEST IF ELMAX > OR = OBSEL
        TMQ     OBSEL
        JAGQF   TACQ10
        JMP     TACQ7
TACQ6   TMA     PPP           COMPUTE DT=(T2-T1)/(PPP-1)
        FSM     F/1.0
        TAM     DT
        TMA     T2
        FSM     T1
```

```
        FDAS    DT
        TMD     T1
        TDM     TI
        JMP     TACQ4A                    $
TACQ2   TMD     F/0.0                 SET A14=0
        TDM     A1H
        TMD     TWOPI                 SET A2H=TWOPI
        TDM     A2H
        TMD     RCPTST                SET STST=RCPTST
        TDM     STST
        CM      RCPTST                SET RCPTST=0
        JMP     HACQUI                SUBROUTINE
        TMD     STST                      $
        TDM     RCPTST                    $
        TMA     DPASS                 TEST UPASS ONLY DPASS=1  NO DPASS =0
        JAZ     TACQ3
        TMD     PAR2                  SET T2=PAR2
        TDM     T2
        CM      BUF1                      $
        JMP     TACQ3



AFILT3  TJM     AFILT3X
        TJM     VISIBLE
        CM      MARG
        FCSM    RHO                   SET ERR= RHOZH-RHO*SINHMIN
        TMQ     SINHMIN
        FMAR
        FAM     RHOZH
        TAM     ERR                   ERR
        TMQ     RHO                   SET EPS=RHO*EPSLN*COSHMIN
        FMMR    EPSLN
        TAM     TEMP1                   TEMP1=RHO*EPSLN
        TMQ     COSHMIN
        FMARS   EPS                   EPS
        JMP     AFILT31               SUBROUTINE
        TMQ     RHO                   SET ERR= (RHO DOT YF)-RHO*COSPSI
        TMA     COSPSI
        FMARS   ERR                      ERR= RHO*COSPSI
        TMQ     RHOXH
        FMMR    YFX
        TMQ     RHOYH
        FMAD    YFY
        TMQ     RHOZH
        FMAD    YFZ                      RHO DOT  YF  COMPLETE
        FSMS    ERR                   ERR
        TMA     TEMP1                 SET EPS= RHO*EPSLN*SINPSI
        TMQ     SINPSI                    TEMP1= RHO*EPSLN
        FMARS   EPS
        JMP     AFILT31               SUBROUTINE
        TMQ     RHOXH                 SET ERR= RHO*UMAXT-ABS(RHO DOT ZF)
        FMMR    ZFX
```

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```
        TMQ     RHOYH
        FMAD    ZFY
        TMQ     RHOZH
        FMAD    ZFZ
        TAQ
        FCAQAS  ERR                        ERR=ABS (RHO DOT ZF)
        TMQ     RHO
        FMMR    UMAXT
        FSMS    ERR                   ERR
        TMA     TEMP1                 SET EPS=RHO*EPSLN*(1-UMAXT**2)**1/2
        TMQ     RT1MUS
        FMARS   EPS                   EPS
        JMP     AFILT31               SUBROUTINE
        TMQ     RHOXH                 SET ERR=RHO*VMAXT-ABS(RHO DOT XF)
        FMMR    XFX
        TMQ     RHOYH
        FMAD    XFY
        TMQ     RHOZH
        FMAD    XFZ
        TAQ
        FCAQAS  ERR                        ERR=ABS(RHO DOT XF)
        TMQ     RHO
        FMMR    VMAXT
        FSMS    ERR                   ERR
        TMQ     TEMP1                 SET EPS=RHO*EPSLN*(1-VMAX**2)**1/2
        TMA     RT1MVS                       $
        FMARS   EPS
        JMP     AFILT31               SUBROUTINE
        TMA     0/2 T16
        AMS     AFILT3X
        TMA     MARG
        JAZ     AFILT3X
        CSM     0/1T16                       $
        AMS     AFILT3X
L AFILT3XJMP    0                     EXIT



AFILT31TJM      AFILX
        TMA     F/0.0                 TEST IS ZERO >OR= ERR
        TMQ     ERR
        JAGQF   AFD1
        FCAQA                         TEST IF ABS(ERR) > OR = EPS
        TMQ     EPS
        JAGQF   AFILX
AFD2    TAM     MARG                  SET MARG NOT ZERO
AFILX   JMP     0                     EXIT
AFD1    CM      VISIBLE               SET VISIBLE = 0
        TMQ     EPS                   TEST IF ABS(ERR) > OR =  EPS
        FCAMA   ERR
        JAGQF   AFILT3X               EXIT FROM AFILT3  ROUTINE
        JMP     AFD2
```

```
 RHARR  TJM    RHARRX     $
        TMA    RHOZH      $  COMPUTE OBSEL =ARCSIN(RHOZH/RHO)
        FDA    RHO        $
        TQA               $
S       FASIN             $
        TAM    OBSEL      $ OBSEL
        TMQ    RHOYH      $ COMPUTE OBSAZ=ARCTAN(RHOYH/
        FCSM   RHOXH      $          =RHOXH)
        JMP    ARCTAN     $ SUBROUTINE
        TAM    OBSAZ      $ S
        TMD    RHO        $ SET OBSR = RHO
        TDM    OBSR       $
 RHARRX JMP    0          $


 STORE  TJM    STOREX     $
        TMA    TF         $ TEST IS ZERO > OR= TI(TF-TO-TI)
        FSM    TO         $
        TMQ    TI         $
        FSQ               $
        FMAR              $
        TAQ               $
        TMA    F/0.0      $
        JAGQF  STOREX     $
        TMA    VPASS      $  TEST IF VPASS=0
        JAZ    STO1R      $
        JMP    ANGSN1     $ SUBROUTINE
        TMQ    XILLUM     $
        TMA    F/0.0      $
        JAGQF  STOREX     $
 STO1R  TMD    TI         $  SET UP INPUT FOR AJPACK
        TDM    AJMIN      $  AJMIN=TI
        TMD    OBSAZ      $
        TDM    AJAZ       $  AJAZ=OBSAZ
        TMD    OBSEL      $
        TDM    AJELEV     $ AFELEV=OBSEL
        TMD    RHO        $
        TDM    AJRANGE    $ AJRANE=RHO
        TMD    OBSRR      $
        TDM    AJRRATE    $ AJRRATE=OBSRR
        TMD    FANNO              $
        TDM    AJFAN              $
        TMQ    T          $
        FMMR   XNO        $
        FDA    TWOPI      $
        TMA    EPREV      $
        FAQS   AJREV      $ AJREV=EPREV+T*XNO/TWOPI
```



```
        TMA    BUF1       $ TEST  IS  BUF1=0
        JAZ    STO2R      $
        TMA    BUF2       $ TEST BUF2> OR= AJMIN
        TMQ    AJMIN      $
        JAGQF  STO3R      $
        TQM    BUF2       $  EXCHANGE
        TAM    AJMIN      $   BUF2=AJMIN  + AJMIN=BUF2
        TMA    BUF1       $
        TMD    AJAZ       $
        TDM    BUF1       $
        TAM    AJAZ       $  AJAZ=BUF1  $  BUF1=AJAZ
        TMA    BUF3       $
        TMD    AJELEV     $
        TDM    BUF3       $
        TAM    AJELEV     $ AJELEV=BUF3  $  BUF3=AJELEV
        TMA    BUF4       $
        TMD    AJRANGE    $
        TDM    BUF4       $
        TAM    AJRANGE    $ AJRANGE=BUF4  +  BUF4=AJRANGE
        TMA    BUF5       $
        TMD    AJRRATE    $
        TDM    BUF5       $
        TAM    AJRRATE    $ AJRRATE=BUF5  +  BUF5=AJRRATE
        TMA    BUF6       $
        TMD    AJREV      $
        TDM    BUF6       $
        TAM    AJREV      $ AJREV=BUF6  +  BUF6=AJREV
        TMA    BUF7S
        TMD    AJFAN              $
        TDM    BUF7S
        TAM    AJFAN              $
 STO3R  JMP    AJPACK     $  SUBROUTINE
 STOREX JMP    0          $ EXIT
 STO2R  TMD    AJAZ       $
        TDM    BUF1       $ BUF1=AJAZ
        TMD    AJMIN      $
        TDM    BUF2       $  BUF2=AJMIN
        TMD    AJELEV     $
        TDM    BUF3       $   BUF3=AJELEV
        TMD    AJRANGE    $
        TDM    BUF4       $   BUF4= AJRANGE
        TMD    AJRRATE    $
        TDM    BUF5       $   BUF5=AJRRATE
        TMD    AJREV      $
        TDM    BUF6       $    BUF6=AJREV
        TMD    AJFAN              $
        TDM    BUF7S
        JMP    STOREX     $


 ENDPK  TJM    ENDPK X    $
        TMA    BUF1       $  TEST IS BUF1=0
```

```
         JAZ     ENDPKX          $
         TMD     BUF1            $  TRANSFER DATA FROM BUF TO AJ;S
         TDM     AJAZ            $
         TMD     BUF2            $
         TDM     AJMIN           $
         TMD     BUF3            $
         TDM     AJELEV          $
         TMD     BUF4            $
         TDM     AJRANGE         $
         TMD     BUF5            $
         TDM     AJRRATE         $
         TMD     BUF6            $
         TDM     AJREV           $
         TMD     0/1T47          $  SET FLAG AJFLGIT
         TDM     AJFLGIT         $
         CM      BUF1            $
         TMD     BUF7$
         TDM     AJFAN                   $
         JMP     AJPACK          $
ENDPKX   JMP     0               $



CRHOB    TJM     CRHOBX          $
         JMP     PRED            $  SUBROUTINE
         TMA     THTAO           $  COMPUTE THTA = THTAO + RPTIM * T
         TMQ     RPTIM           $
         FMAD    T               $
         TAM     THTA            $   THTA
S        FSIN                    $       $

         TAM     SINTH           $       $
S        FCOS    THTA            $       $

         TAM     COSTH           $       $
         TMQ     XOVCT           $ COMPUTE CAPX = CAPX = XOVCT*COSTH
         TMA     COSTH           $
         FMARS   CAPX            $   CAPX
         TMA     SINTH           $ COMPUTE  CAPY= XOVCT*SINTH
         FMARS   CAPY            $   CAPY     QREG=XOVCT
         FAM     Y               $ COMPUTE  RHOXH= (X+CAPX)SINPH*COSTH
         TAM     TEMP1           $      +(Y+CAPY)SINPH*SINTH -
         TMQ     SINTH           $       (Z+CAPZ)COSPH
         FMARS   TEMP2           $   TEMP1= Y+CAPY  TEMP2= (Y+CAPY)SINTH
         TMA     X               $
         FAM     CAPX            $
         TAM     TEMP3           $   TEMP3=X+CAPX
         TMQ     COSTH           $
         FMARS   TEMP4           $   TEMP4=(X+CAPX)COSTH
         TMA     Z               $
         FAM     CAPZ            $
         TAM     TEMP5           $   TEMP5= Z+CAPZ
```



```
         TMQ     COSPH           $
         FMAR                    $
         TMQ     SINPH           $
         FMSU    TEMP2           $
         FMAD    TEMP4           $     TEMP4= (X+CAPX)COSTH
         TAM     RHOXH           $  RHOXH
         TMQ     SINTH           $ COMPUTE  RHOYH=(Y+CAPY)COSTH
         FMMR    TEMP3           $                  -(X+CAPX)SINTH
         TMQ     COSTH           $    TEMP3=(X+CAPX)
         FMSU    TEMP1           $    TEMP1=(Y+CAPY)
         TAM     RHOYH           $  RHOYH
         TMQ     SINPH                 $
         FMMR    TEMP5           $    (Y+CAPZ)COSPH*XSINTH+(Z+CAPZ)SINTH
         TMQ     COSPH           $     TEMP5=Z+CAPZ
         FMAD    TEMP2           $     TEMP2=(Y+CAPY)SINTH
         FMAD    TEMP4           $      TEMP4=(X+CAPX) COSTH
         TAM     RHOZH           $  RHOZH
         TAQ                     $ COMPUTE RHO =(RHOXH**2+RHOYH**2
         FMAR                    $              +RHOZH**2)**1/2
         TMQ     RHOXH           $
         FMAD    RHOXH           $
         TMQ     RHOYH           $
         FMAD    RHOYH           $
         TAM     RHOSQRD         $
S        FSQRT                   $

         TAM     RHO             $  RHO
         TMA     XDOT            $ COMPUTE OBSRR=(1/P)(X+CAPX)(XDOT+THDOT
         TMQ     THDOT           $    +(Y+CAPY)(YDOT-THDOT*X)+(Z+CAPZ)
         FMAD    Y               $    *ZDOT
         TAM     TEMP2           $   TEMP2= XDOT+THDOT*Y
         FMMR    X               $
         FSM     YDOT            $
         TMQ     TEMP1           $   TEMP1= Y+CAPY
         FMAR                    $
         TMQ     ZDOT            $
         FMSU    TEMP5           $   TEMP5= Z+CAPZ
         TMQ     TEMP2           $    TEMP2= XDOT+ THDOT*Y
         FMAD    TEMP3           $    TEMP3= X+CAPY
         FDA     RHO             $
         TQM     OBSRR           $ OBSRR
CRHOBX   JMP     0               $ EXIT



PRED     TJM     PREDX           $

         TMA     TI              $ COMPUTE T= TI-EPOCHM
         FSM     EPOCHM          $
         TAM     T               $  T
         JMP     XYZSB           $  SUBROUTINE
PREDX    JMP     0               $ EXIT
```

```
 CRDOT   TJM     CRDOTX          $
         TMQ     T               $ COMPUTE RHODOT= (XDOT+THDOT*Y)*COSPH
         FMMR    RPTIM                     $
         FAM     THTAO           $    +ZDOT*SINPH
         TAM     THTA            $   THTA=THTAO+THDOT*T
S        FCOS                    $

         TAM     COSTH           $
         TMQ     COSPH           $
         FMARS   CCPHTH          $  CCPHTH = COSPH*COSTH
         TMA     THTA            $
S        FSIN                    $

         TAM     SINTH           $
         TMQ     COSPH           $
         FMARS   CSPHTH          $   CSPHTH = COSPH*SINTH
         TMQ     X               $
         FMMR    THDOT           $
         FSM     YDOT            $
         TMQ     CSPHTH          $
         FMARS   RHODOT          $  USED AS TEMP
         TMQ     Y               $
         FMMR    THDOT           $
         FAM     XDOT            $
         TMQ     CCPHTH          $
         FMAR                    $
         TMQ     ZDOT            $
         FMAD    SINPH           $
         FSMS    RHODOT          $ RHODOT
         TMA     OBSRR                     $
         FDA     RHO                       $
         FMMR    RHOZH                     $
         FSM     RHODOT                    $
         FDA     RHO                       $
         FCSQS   RHODOT                    $
 CRDOTX  JMP     0               $ EXIT



 CRDDOT  TJM     CRDDOTX         $
         TMA     RHODOT                    $
         FSM     OLD ONE                   $
         FDA     DT                        $
         TJM     RHODDOT                   $
 CRDDOTXJMP      0               $ EXIT
```



```
  NXPASS TJM     NXPASSX         $
  NXPAS12TMD     LSTT            $ SET TI=LSTT
         TDM     TI              $
         JMP     ZDWI            $  SUBROUTINE
  NXPAS7 TMA     TI              $ TEST IF TF IS GREATER THAN OR EQUAL TO
         FAM     TO              $
         TAQ                     $
         TMA     TF              $  TI-IF YES JMP-IF NO EXIT
         JAGQF   NXPAS1          $
L NXPASSXJMP     0               $ EXIT
  NXPAS1 JMP     CZDOTW          $ SUBROUTINE
         FCAMA   ZDOTW           $ TEST IF ABS(ZDOTW) IS GREATER THAN OR
         TMQ     K1              $     EQUAL TO K1 -IF YES JMP
         JAGQF   NXPAS2          $
         FCSM    DT1             $ COMPUTE TI=TI-DT1
         FAMS    TI              $
  NXPAS6 JMP     CRHOB                     $
         JMP     CRDOT           $ SUBROUTINE
         TMA     F/0.0           $ TEST IF RHODOT IS GREATER THAN ZERO
         TMQ     RHODOT          $
         JAGQF   NXPAS3          $
  NXPAS5 TMA     DT2             $ SET  TI=TI+DT2
         FAMS    TI              $
         JMP     CRHOB                     $
         JMP     CRDOT           $ SUBROUTINE
         TMA     F/0.0           $ TEST IF ZERO IS GREATER THAN OR EQUAL
         TMQ     RHODOT          $     TO RHODOT - IF YES JMP
         JAGQF   NXPAS4          $
         JMP     NXPAS5          $
  NXPAS3 TMA     DT2             $ SET TI=TI+DT2
         FAMS    TI              $
         JMP     NXPAS6          $
  NXPAS2 TMA     DT1             $ SET TI=TI+DT1
         FAMS    TI              $
         JMP     NXPAS7          $
  NXPAS4 TMD     DT2             $ SET DT=DT2
         TDM     DT              $
         CM      N               $  N=0
  NXPAS9 FCSMA   DT              $ COMPUTE DT= -.5*ABS(DT)
         TMQ     F/.5            $
         FMARS   DT              $
  NXPAS10FAMS    TI              $ SET TI=TI+DT
         TMA     D/1B15          $ SET N=N+1   FIX PT B15
         AMS     N               $
         JMP     CRHOB                     $
         JMP     CRDOT           $ SUBROUTINE
         TMA     N               $ TEST IF N=NMAX  NMAX=7  FOR 1ST CUT
         TMD     NMAX            $
         JAED    NXPAS8          $
         TMA     F/0.0           $ TEST IF ZERO IS GREATER THAN OR EQUAL
         TMQ     RHODOT          $     RHODOT
         TQM     OLD ONE                   $
         JAGQF   NXPAS9          $
         FCAMA   DT              $ SET DT= +.5*ABS(DT)
         TMQ     F/.5            $
```

```
         FMARS    DT            $
         JMP      NXPAS10       $
NXPAS8   JMP      CRDDOT        $ SUBROUTINE
         TMA      RHODOT        $ TEST IF ABS(RHODOT/RHODDOT) IS
         FDA      RHODDOT       $     GREATER THAN OR EQUAL TO
         TQM      TEMP1         $     ABS(DT/2)
         TMA      DT            $   TEMP1=RHODOT/RHODDOT
         FDA      F/2.0         $
         FCAQAS   TEMP2         $  TEMP2=ABS(DT/2)
         FCAMA    TEMP1         $
         TMQ      TEMP2         $
         JAGQF    NXPAS11       $
         FCSM     TEMP1         $ SET  TI=TI-RHODOT/RHODDOT
         FAMS     TI            $
NXPAS14  JMP      CRHOB         $ SUBROUTINE
         TMA      DT1           $ COMPUTE LSTT=TI+DT2+DT1
         FAM      DT2           $
         FAM      TI            $
         TAM      LSTT          $ LSTT
         TMA      F/0.0         $ TEST IF ZERO IS GREATER THAN RHOZH
         TMQ      RHOZH         $
         JAGQF    NXPAS12       $
         TMA      D/1B16        $ INCREMENT RETURN ADDRESS BY 1 INSTOR1H
         AMS      NXPASSX       $
         JMP      NXPASSX       $ EXIT
NXPAS11  TMA      RHODOT        $ COMPUTE TI=TI+(RHODOT/ABS(RHODOT))*
         TMQ      TEMP2         $        ABS(DT/2)
         JAP      NXPAS13       $
         FCSQ                   $
         TAQ                    $
NXPAS13  FCAQ                   $
         FAMS     TI            $ TI
         JMP      NXPAS14       $

DT1      F/5                            $
DT2      F/25                           $
NMAX     O/7 T15                $ CONSTANT



EINIT    TJM      EINITX        $
         JMP      XYZI          $ SUBROUTINE
         CM       T             $  SET T=0
         JMP      XYZSB         $  SUBROUTINE
         TMQ      EPOCH         $  COMPUTE EPOCHM= EPOCH*XMNPDA- TO
         FMMR     XMNPDA        $
         FSM      TO            $
         TAM      EPOCHM        $  EPOCHM
         TMO      RPTIM         $  COMPUTE THTAO= THTAI+RPTIM*EPOCHM
         FMAR                   $
         FAM      THTAI         $
         TAM      THTAO         $ THTAO
         TMA      XNODOT        $         $
```



```
         FSM      RPTIM         $                   *DT1)
         TMQ      DT1           $
         FMARS    TEMP1         $  TEMP1=(XNODOT-THDOT)*DT1
S        FSIN                   $

         TAM      SDEL          $
         TMA      TEMP1         $  COMPUTE CDEL = SIN(TEMP1)
S        FCOS                   $

         TAM      CDEL          $
         TMQ      SINPH         $  COMPUTE  SPCI= SIN PH*COSI
         TMA      COSI          $
         FMARS    SPCI          $
         TMQ      SINI          $ COMPUTE  CPSI = COSPH*SINI
         TMA      COSPH         $
         FMARS    CPSI          $
         TMA      EO            $  COMPUTE  Q2 =AO(1+EO)
         FAM      F/1.0         $
         TMQ      AO            $
         FMARS    Q2            $
         FCSM     FANTAB+5      $        $
         TMQ      FANTAB+5      $        $
         FMAR                   $
         FAM      F/1.0         $
         TAM      TEMP1         $  TEMP1= COSHMIN**2
S        FSQRT                  $

         TAM      TEMP2         $  TEMP2= COSHMIN
         TMQ      Q2            $
         FMMR     Q2            $
         FSM      TEMP1         $
S        FSQRT                  $

         FSM      SINHMIN       $
         FDA      Q2            $
         FMMR     TEMP2         $
         TAM      K1            $ K1
         CM       LSTT          $  SET LSTT=0
         TMD      C/HLT,SATNOS  $ COMPUTE REV.NO) AT START TIME,FIX,IT,
         TDXLC    ,1            $     AND PUT INTO SATNOS TABLE
         TMD      SATCONT       $
         ADXL     ,1            $
         FCSM     EPOCHM                 $
         FSM      F/1440.0      $
         FDA      TWOPI         $
         FMMR     XNO           $
         FAM      EPREV         $
         JAP      (P)+2H        $
         TMA      F/0.0         $
         TAQ                    $
         JMP      AJFIXIT       $
         SLA      30            $  STORE
         TMQ      3/1T2;30/1T47 $
         EIS      0,1           $
EINITX   JMP      0             $  EXIT
```

```
SINIT  TJM     SINITX         $
       TMA     BEGT           $  COMPUTE TO=BEGT*XMNPDA
       TMQ     XMNPDA         $
       FMARS   TO             $
       TMA     ENDT           $ COMPUTE  TF=ENDT*XMNPDA
       FMARS   TF             $
       TMA     PHIRD          $  COMPUTE  COSPH =COS(PHIRD)
S      FCOS                   $

       TAM     COSPH          $
       TMA     PHIRD          $   COMPUTE  SINPH= SIN(PHIRD)
S      FSIN                   $

       TAM     SINPH          $
       TMQ     BEAMW          $  COMPUTE EPSLN=.5*BEAMW*D2R
       FMMR    F/.5           $
       TMQ     DE2RA          $     D2R= DEGREES TO RADIANS CONSTANT
       FMARS   EPSLN          $
       CM      BUF1           $  BUF1=0
       TMA     BEGT           $  COMPUTE  THTAI
       JMP     FYKLOK         $  SUBROUTINE
       TAM     TOY            $
       TQA                    $
       JMP     SEPSUB         $   SUBROUTINE
       TAM     ORGDA          $
       TQM     ORGTM          $
       TMQ     TOY            $
       JMP     TLC            $   SUBROUTINE
       TMQ     ORGDA          $
       FMMR    SIDRT          $
       TMQ     ORGTM          $
       FMAD    SIDRT+1        $
       FAM     THGRO          $
       TMQ     DE2RA                    $
       FMAR                             $
       FAM     XLAMBA         $
       TAM     THTAI                    $
SINITX JMP     0              $ EXIT



ZDWI   TJM     ZDWIX          $
       FCSM    DT1                      $
       FAMS    TI                       $
       JMP     PRED           $ SUBROUTINE
       TMA     THTAO          $ COMPUTE THTA=THTAO+THDOT* T
       TMQ     RPTIM                    $
       FMAD    T              $
```



```
          TAM     THTA           $ THTA
          TAQ                    $ COMPUTE SNMT =SIN(XNODE-THTA)
          TMA     XNODE          $
          FSQS    CNMT           $    CNMT USED AS TEMP = XNODE-THTA
S         FSIN                   $

          TAM     SNMT           $ SNMT
          TMA     CNMT           $ COMPUTE CNMT=COS(XNODE-THTA)
S         FCOS                   $

          TAM     CNMT           $ CNMT
          TMA     DT1                      $
          FAMS    TI                       $
  ZDWIX   JMP     0              $



  CZDOTW  TJM     CZDOTWX        $
          TMQ     SNMT           $ TEMP1=SNMT*CDEL+CNMT*SDEL   TO COMPUTE
          FMMR    CDEL           $
          TMQ     SDEL           $
          FMAD    CNMT           $
          TAM     TEMP1          $ TEMP1
          FMMR    SNMT           $ COMPUTE CNMT=CNMT*CDEL-SNMT*SDEL
          TMQ     CDEL           $
          FMSU    CNMT           $
          TAM     CNMT           $ CNMT
          TMQ     TEMP1          $ SET SNMT= TEMP1
          TQM     SNMT           $
          TMA     SPCI           $ COMPUTE ZDOTW=SNMT*CPSI+SPCI
          FMAD    CPSI           $
          TAM     ZDOTW          $
  CZDOTWXJMP      0              $ EXIT
```

```
         SAME     XYZSB,XYZ3      $
         ASGN     DTERM,     M/3752$
         SAME     BJTLCE,M/3 $
XYZI     TJM      (P)+3H          $
         JMP      BEGIN           $
         JMP      NTHCN           $  XYZ+1
         JMP      (P)             $
XYZ1     TJM      XYZSWT1         $
         JMP      XYZK25+1H       $
XYZ2     TJM      XYZSWT2         $
         JMP      (P)+4H          $
XYZ3     TJM      XYZSBX      $
         TIJ      XYZSB3$
         TJM      XYZSWT2         $
         TIJ      XYZSWT1+1H      $
         TJM      XYZSWT1         $
         JMP      XYZK25+1H       $
XYZSBG   TJM      XYZSBX          $
         TIJ      XYZSB3          $
         TJM      XYZSWT2         $
         JMP      XYZSB2          $
```



```
BEGIN    TJM      BEGINX$
         TMQ      HXO$
         FMMR     HXO$
         TMQ      HYO$
         FMAD     HYO$
         TMQ      HZO$
         FMAD     HZO$
         TAM      P$
           TDM    PO          $
S        FSQRT    $

         TAM      RTP$
         TMA      F/1$
         FDA      RTP$
         FMMR     HXO$
         TAM      WX$
         FMMR     HYO$
         TAM      WY$
         FMMR     HZO$
         TAM      WZ$
         TDM      COSI$
         TDQ      $
         FCSQ     $
         FMAR     $
         FAM      F/1$
S        FSQRT    $

         TAM      SINI$
         TDM      XMZ$
         TDQ      $
         TMA      COSI$
         JMP      ARCTAN$
         TAM      XINCL$
         TMA      F/1$
         FDA      SINI$
         FMMR     WX$
         TAM      SINO$
         FMMR     WY$
         TAQ      $
         FCSQS    COSO$
         TMQ      SINO$
         JMP      ARCTAN$
         TAM      XNODEO$
         TMQ      AXNO$
         FMMR     AXNO$
         TMQ      AYNO$
         FMAD     AYNO$
         TAM      ESQ$
S        FSQRT    $

         TAM      EO$
         TMA      F/1$
         FSM      ESQ$
         TAM      AO$
S        FSQRT    $
```

```
         TAM      RTESQS
         TMA      PS
         FDAS     AOS
         TQA      S
S        FSQRT    S

         TAM      RTAS
         TMA      XNODEOS
         TMQ      WZS
         JQN      (P)+2HS
         FCSM     XNODEOS
         FAM      XLOS
         TAM      UOS
         TMQ      SINIS
         FMMR     SINIS
         FDA      F/.666666667S
         FCSQ     S
         FAM      F/1S
         FDA      PS
         FMMR     RTESQS
         FDA      PS
         FMMR     P3JAO2S
         FDA      F/2S
         TMA      F/1S
         FSQ      S
         TAM      XNOREVS
         FDA      AOS
         FMMR     XKERTMS
         FDA      RTAS
         TQM      XNOS
         FMMR     XNOS
         FDA      PIO36S
         FMMR     COS
         TAM      CS
  BEGINX JMP      0S

  DELTPI S
  XNOREV S
  NTHCN  TJM      NTHCNXS
         TMQ      AOS
         TMA      F/1S
         FSM      EOS
         FMARS    QOS
         TMA      SINIS
         FDA      F/-.4S
         FMMR     SINIS
         FAM      F/2S
         FSMA     COSIS
         FDA      PS
         FMMR     P3JAO2S
         FDA      PS
         TQM      DELTPIS
         TMQ      XM4O3S
         FMMR     CS
```



```
         TAM      XM4CO3S
  NTHCNX JMP      0S
```

```
 XYZS9X    JMP   (P)               $
 XYZK25 TJM      XYZS8X            $
        TMA      F/.06     $
        TMQ      EO        $
        JAGQF    (P)+3H    $ COMPUTE D IF E LESS THAN .06
        TMA      F/0       $
        JMP      NODTERM   $ SET D = 0
        TMA      XYZND              $
        FSM      XNO       $
        TMQ      F/0.20061256E-2$                  K-66
        JAGQF    (P)+3H    $
        TMQ      F/13.0    $                       K-66
        JMP      (P)+5H    $
        TMQ      F/3       $
        FMARS    A         $
        FAM      XYZND              $
        FDA      A         $
        FMMR     C         $
        FDA      1OVA      $                       K-66
        FMMR     C         $
 NODTERMTAM      DTERM     $ END COMPUTING D
        TMQ      F/1.5     $ START COMPUTING A
        FMMR     DTERM     $
        TMQ      T         $
        FMAR               $
        FAM      C         $
        FMAR               $
        TMQ      F/2       $
        FMAR               $
        FAM      F/1       $
S       FLOG2X   $

        TMQ      F/-.666666667$
        FMAR               $
S       F2X      $

        TMQ      AO        $
        FMARS    A         $ END COMPUTING A
S       FSQRT    $

        TAM      RTA$
        TMQ      A$
        FMARS    XN$
        TMA      XKE$
        FDAS     XN$
        TMA      F/1E-10   $                       K-66
        TMQ      EO        $                       K-66
        JAGQF    (P)+4H    $                       K-66
        TMA      A$
        TMQ      QO$
        JAGQF    (P)+7H    $                       K-66
        TMD      F/0$
        TDM      E$
        TDM      ESQ       $                       K-66
        TMA      A         $                       K-66
```



```
        TDM      P        $                        K-66
        JMP      TAGRS    $                        K-66
        TQA      $
        FDA      A$
        TMA      F/1$
        FSQS     E$
        TDQ      $
        FMMR     E$
        TAM      ESQ$
        TMA      F/1$
        FAM      E$
        TMQ      QO$
        FMARS    P$
S TAGRS FSQRT    $                                 K-66

        TAM      RTP$
           TMA   P3JAO2     $
           FDA   PO         $
           FMMR  XNO        $
           FDA   PO         $
           TQM   OMGDT      $
           FCSM  COSI       $
           FMARSXNODOT      $
        TDQ      $
        TMA      XNODEO$
        FMAD     T$
        TAM      XNODE$
  XYZSWT1JMP     (P)                $
  XYZS82 TMA     F/1$
        FSM      ESQ$
S       FSQRT    $

        TAM      RTESQ$
           FCSM  SINI       $
           TMQ   SINI       $
           FMAR             $
           TMQ   FLO 5      $
           FMAR             $
           FAM   FLO 4      $
           FDA   FLO 2      $
           FMMRSOMGDT       $
        TMQ      T$
        FMARS    OMGAS$
S       FCOS     $

        TAM      U$
           TMA   OMGAS              $
S       FSIN     $

        TAM      XL$
        TMA      F/0$
        TMD      EO$
        JAED     XYZSB7$
        FCSM     AYNO$
        TMQ      XL$
```

```
         FMAR     $
         TMQ      U$
         FMAD     AXNO$
         FDA      EO$
         FMMR     E$
         TAM      AXN$
         TMQ      U$
         FMMR     AYNO$
         TMQ      XL$
         FMAD     AXNO$
         FDA      EO$
         FMMR     E$
         TAM      AYN  $
XYZSB10  TMA      SINI$
         FDA      P$
         FMMR     MJ3AOJ2$
         FDA      F/2$
         TQM      L3$
         TQA      $
         FAMS     AYN$
XYZSB9   TMQ      T          $
         FMMR     DTERM      $
         FAM      C          $
         FMAR                $
         FAM      F/1        $
         FAM      DELTPI     $
         FMAR                $
         TAQ                 $
         FMMR     XNO        $
         FAM      XLO        $
         TAM      XL         $
         TMA      F/1$
         FAMA     COSI$
         TAM      DENOM$
         TAQ      $
         FMMR     F/5$
         FSM      F/2$
         FDA      DENOM$
         FMMR     AXN$
         FDA      F/2$
         FMMRS    L3$
         FAMS     XL$
         TMQ      F/0$
         TMA      WZ$
         JAGQF    XYZSB21$
         TMA      XL$
         FAM      XNODE$
XYZSB22  FDA      TWOPI$
         TQA      $
         JMP      SEPSUB$
         FMMR     TWOPI$
         TAM      U$
XYZSWT2  JMP      (P)                $
XYZSB21  FCSM     XNODE$
         FAM      XL$
```



```
          JMP      XYZSB22$
XYZSB3       TMA   XNODE           $
S         FSIN     $

          TAM      XNY$
          TDM      SINO$
             TMA   XNODE           $
S         FCOS     $

          TAM      XNX$
          TDM      COSO$
          TMQ      SINI$
          FMMR     XNY$
          TAM      WX$
          FCSM     XNX$
          FMARS    WY$
          TMQ      COSI$
          FCSM     XNY$
          FMARS    XMX$
          FMMR     XNX$
          TAM      XMY$
          TMA      RTESQ$
          FAM      F/1$
          TAQ      $
          FMAR     $
          TMQ      RTESQ$
          FMARS    DENM$
          TMD      U$
          TDM      E01$
XYLP         CM    XYZSBZ          $
             TMA   E01             $
S         FSIN     $

          TAM      SINEO$
             TMA   E01             $
S         FCOS     $

          TAM      COSEO$
          TDQ      $
          TMA      AYN$
          FMAR     $
          TMQ      AXN$
          FMSU     SINEO$
          TAM      ESINE$
          FAM      U$
          TAM      E02$
          FSM      E01$
          TAQ      $
          FCAQA    $
          TMQ      TENM6$
          JAGQF    XYLP1$
          JMP      XYZLP2$
XYLP1     TMD      E02$
          TDM      E01$
             TMA   N/30T15         $
```

```
         INCA XYZSBZ            $
         JAED (P)+2H            $
         JMP  XYLP+1W           $
XYZLP2 TMQ    SINEOS
       FMMR   AYNS
       TMQ    COSEOS
       FMAD   AXNS
       TAM    ECOSES
       TDQ    $
       TMA    F/1S
       FSQ    $
       TMQ    AS
       FMARS  RS
       TQA    $
       FDA    RS
       TQM    ARS
       TMA    RTAS
       FDA    RS
       FMMR   ESINES
       TAM    RDOTS
       FMMR   RTESQS
       TAM    RVDOTS
       TMA    RTESQS
       FAM    F/1S
       TAM    SINUS
       TMA    ESINES
       FDAS   SINUS
       FCSM   AXNS
       TMQ    SINUS
       FMAD   AYNS
       FAM    COSEOS
       TMQ    ARS
       FMARS  COSUS
       FCSM   AXNS
       TAQ    $
       FCSM   AYNS
       FMAD   SINUS
       FAM    SINEOS
       TMQ    ARS
       FMARS  SINUS
       TMQ    COSUS
       FMMR   XNXS
       TMQ    SINUS
       FMAD   XMXS
       TAM    UXS
       FMMR   XNXS
       TMQ    COSUS
       FMSU   XMXS
       TAM    VXS
       FMMR   XNYS
       TMQ    SINUS
       FMAD   XMYS
       TAM    UYS
       FMMR   XNYS
       TMQ    COSUS
```



```
       FMSU   XMYS
       TAM    VYS
       FMMR   XMZS
       TAM    VZS
       TMQ    SINUS
       FMMR   XMZS
       TAM    UZS
       TMQ    RS
       FMMR   UXS
       TAM    XS
       FMMR   UYS
       TAM    YS
       FMMR   UZS
       TAM    ZS
       TMQ    RDOTS
       FMMR   UXS
       TMQ    RVDOTS
       FMAD   VXS
       TAM    XDOTS
       FMMR   VYS
       TMQ    RDOTS
       FMAD   UYS
       TAM    YDOTS
       FMMR   UZS
       TMQ    RVDOTS
       FMAD   VZS
       TAM    ZDOTS
       JMP    XYZSBXS
XYZSB7 TDM    AYNS
       TMD    ES
       TDM    AXNS
       JMP    XYZSB10S
C ARCTAN TJM  ONODE8S
       TAM    ONODE10S
       TQM    ONODE10+1S
       TMA    F/0S          NODE ACCORDING TO
       TMD    ONODE10S
       JAED   ONODE5S
       JDP    ONODE1S       USED. THE A,Q,D REGISTERS
       TMA    PIS
       JMP    ONODE3S       ENTRY
ONODE1 THD    ONODE10+1S
       JAED   ONODE8S
       JDP    ONODE3S       THE RESULT IS STORED IN
       TMA    TWOPIS
ONODE3 TAM    ONODE10+2S
       JMP    ONODE7S       10TH. SIGNIFICANT DECIMAL DIGIT
ONODE5 TMD    ONODE10+1S
       JAED   ONODE8S
       JDP    ONODE6S       SUBROUTINE.....
       TMA    X3PIO2S
       JMP    ONODE8S
ONODE6 TMA    PIOV2S
       JMP    ONODE8S
ONODE7 THA    ONODE10+1S
```

```
         FDA      ONODE10$
         TQA      $
S        FATAN    $

         FAM      ONODE10+2$
  ONODE8 JMP      0$
L ONODE10SET      (P)+3$



* GENERALIZED SUBROUTINE TO CONVERT ANY FLOATING
*   POINT NUMBER TO ITS FRACTIONAL AND INTEGRAL
*   PARTS. NUMBER IN ACC. AT ENTRY. INTEGER IN ACC.,
*   FRACTION IN Q REG. ON EXIT.
C SEPSUB TJM      SEPSUBX$
         TAM      SEPSUB3$
         FCAMA    SEPSUB3$
         TMQ      1/1T1;0/43T47$
         JAGQF    SEPSUB1$
         TAQ      $
         ETA      1/1T36$
         JAZ      (P)+4H$
         TMA      F/0$
         TMQ      SEPSUB3$
         JMP      SEPSUBX$
         ETA      11/1T47$
         SLA      8$
         AM       C/CA;C/SLAQN,12$
         TAM      SEPSUB2$
         SRQ      12$
L SEPSUB2  CA     $
           SLAQN 12+0$
         SLA      12$
         AM       D/35$
         TAM      SEPSUB2$
         TMD      SEPSUB3$
         JDP      (P)+5H$
         FCSQ     $
         TAQ      $
         FCSM     SEPSUB2$
         JMP      (P)+4H$
         FCAQ     $
         TAQ      $
         FCAM     SEPSUB2$
  SEPSUBXJMP      0$
  SEPSUB1TMQ      F/0$
         TMA      SEPSUB3$
         JMP      SEPSUBX$
  SEPSUB3$
```



```
  TLC    TJM      TLC4$
         TXDLC    ,1$
         TDM      TL2$
         TMD      TL1$
         TDXLC    ,1$
         ETD      6/1T47$          TLC
         TDQ      $
         TMA      D/9$
         JAGQ     (P)+2H$
         JMP      BJTLCE  $
         MM       TL3$
         TQA      $
         SLA      8$
         TMQ      TL4$
         EIS      TLC1$
         EIS      TLC2$
         EIS      TLC3$
R TLC1   TMD      ,1$
         TDM      THGRO$
R TLC2   TMD      ,1$
         TDM      XLSUNO$
R TLC3   TMD      ,1$
         TDM      C3$
         TMD      TL2$
         TDXLC    ,1$
  TLC4   JMP      $
  TL1    C/HLTR,YCONS$
  TL2    $
         1/1$ CONSTANTS MUST FOLLOW THIS WORD
  CGP    $
  MJ3A0J2F/2.1251E-3$                          CN T-266
  10VA   F/0.25         $                        K-66
  DENOM  $
  L3     $
  XY1    $
  TL3    D/3$
  TL4    28/1;12/0;8/1$
*  A-1 HLT REMOVED
  XYZSBZ $
  XYZND  F/.072722052$                           CN T-29
  YCONS  F/98.67401$
         F/278.6797$
         F/-3.5728$
         F/99.42094$
         F/279.4267$
         F/-2.8431$
         F/99.18222$
         F/279.1879$
         F/-3.0990$
         F/98.94349$
         F/278.9491$
         F/-3.3549$
         F/98.70477$
         F/278.7104$
```

```
        F/-3,6108$
        F/99,45170$
        F/279,4573$
        F/-2,8811$
        F/99,21297$
        F/279,2186$
        F/-3,1370$
        F/99,39017$
        F/279,3958$
        F/-2,8050$
        F/99,15144$
        F/279,1571$
        F/-3,0610$
        F/98,91273$
        F/278,9184$
        F/-3,3169$
```



```
  ER10    TJMR    EREX$
          TMQ     EREX$
          ETA     O/4T39$
          JAZ     EREXP$
          TIJ     PRERS$
          TJM     E3FWR1$
          TQD     $
          TDXLC   ,1$
          SIXOL   1,1$
          TMA     ,1$
  ER11    SM      D/1B16$
          SRA     32$

R         RPTNN   5$
          SRAQ    3$
          BRQ     3$
          TQM     PRERL$
          TMA     E3WOR$
          JMP     GLOP.GLOP$
  ER12    TMA     PHAIN$
          JAZ     NXTCASE                      $
          TMD     F/1.0$
          JAED    NXTEL$
          TMD     F/2.0$
          JAED    START3                       $
          TMD     F/3.0$
          JAED    START2                       $
          TMQ     F/5                          $
          JAGQF   (P)+2H                       $
          JMP     NXTCASE                      $
          TIXZ    0,4                          $
          JAEQ    TRERR                        $
          JMP     FNERR                        $
  EREXP   TIJ     PRERE$
          TJM     E3FWR1$
          ETA     O/77777T15$
          JMP     ER11$

  PRERS   A/SUBROUTINE ERROR $


  PRERE   A/EXPONENT OVERFLOW$


  PRERC   A/FROM LOCATION$

  PRERL   $
L E3WOR   HLT     $
          TIJL    E3FWOR$
  E3FWOR  HLT     17+128+17$
  E3FWR1  TMA     $
          HLT     31+128+13$
          TMA     PRERC$
          HLT     37+128+5$
          CAM     PRERL$
```

```
L EREX    HLT      $
          HLT      $
  TLCE    TMD      SATNS
          SCD      18S
          TDM      PSATNS
          TMA      TWOR1S
          JMP      GLOP.GLOPS
          JMP      NXTELS
L TWOR1   HLT      $
          TIJL     TFWORS
L TFWOR   HLT      15+128+11S
          TMA      PRELMS
          HLT      23+128+3S
          TMA      PSATNS
          HLT      37+128+16S
          CAM      PRTLCS
  PRTLC   W/ILLEGAL $
          W/YEAR     $
  PRELM   A/ELEMENT NO.S

  ANGSN1  TJM      ANGSNXS
          TMA      TI                                $
          FDA      XMNPDAS
          TMA      ORGDA                             $
          FAM      ORGTM                             $
          FAQ      $
          TMQ      C1S
          FMARS    TEMS
          FAM      C3S
          TMQ      DE2RAS
          FMAR     $
A         FSIN     $

          TAQ      $
          FMMR     C2S
          FAM      TEMS
          FAM      XLSUNOS
          TAM      XLSUNTS
          FDA      RADYNS
          FMMR     F/2.0S
A         FSIN     $

          TMQ      C4S
          FMAR     $
          FSM      XLSUNTS
          TAQ      $
          FCSM     DE2RAS
          FMARS    ALSUNS
A         FCOS     $

          TAM      CSALSS
A         FSIN     ALSUNS

          TAM      SNALSS
```



```
          TDQ      $
          FMMR     C5S
A         FATAN    $

          TAM      DLSUNS
A         FSIN     $

          TAM      SNDLSS
          TDM      SUNLZS
A         FCOS     DLSUNS


          TAM      CSDLSS
          TMQ      CSALSS
          FMARS    SUNLXS
          TMQ      CSDLSS
          FMMR     SNALSS
          TAM      SUNLYS
          TMQ      CAPXS
          FMMR     CAPXS
          TMQ      CAPYS
          FMAD     CAPYS
          TMQ      CAPZS
          FMAD     CAPZS
A         FSQRT    $

          TAM      CAPRS
          TMQ      CAPXS
          FMMR     SUNLXS
          TMQ      CAPYS
          FMAD     SUNLYS
          TMQ      CAPZS
          FMAD     SUNLZS
          FDA      CAPRS
          FCSQS    SNHSNS
          FAM      F/.0871557                $ SINE 5 DEGREES
          JAN      ANGSN2S
  ANGSN3  TMD      F/-1.0S
          TDM      XILLUMS
  ANGSNX  JMP      (P)S
  ANGSN2  TMQ      SUNLX                     $
          FMMR     XS
          TMQ      SUNLYS
          FMAD     YS
          TMQ      SUNLZS
          FMAD     ZS
          TAQ                                $
          FMAR                               $
          TMQ      R                         $
          FMSU     R                         $
          TMQ      F/1                       $
          JAGQF    CALIL2                    $
          JMP      ANGSN3                    $
  CALIL2  TMD      F/1.0S
          TDM      XILLUMS
```

```
        JMP       ANGSNXS
```



```
AJPACK TJM    AJPKXX              $
       CD                         $
       TXDLC  0,3X                $
       TXDRC  0,4X                $
       TDM    AJSV34              $
       TMD    AJCOL79             $     BUFFER AND BL
       TDXLC  0,4X                $
       TMA    AJHOLD              $
       FAM    AJMIN               $
       TAQ                        $
       FMMR   F/100.              $
       FAM    F/.4                $     100 X MINUTES
       TAQ                        $
       JMP    AJFIXIT             $
       SLA    25                   $
       TAM    0,4X                $
       TMA    SATCONTS
       SRA    19                   $
       AMS    0,4S
       TMQ    AJAZ                $     10 X AZ AT T4
       FMMR   F/572.957795        $
       FAM    F/.4                $
       TAQ                        $
       JMP    AJFIXIT             $
       SLA    1                   $
       AM     AJFLGIT             $
       CM     AJFLGIT             $
       AMS    0,4X                $
       TMA    4C4+2                $
       JAZ    (P)+4H               $
       TMA    ELNO                 $
       SLA    32                   $
       JMP    4ELNO3               $
       TMQ    AJREV               $     REV No. AT T1
       JMP    AJFIXIT             $
       SLA    30                   $
       TMD    C/HLT,SATNOS         $
       TDXLC  ,1                   $
       TMD    SATCONT              $
       ADXL   ,1                   $
       TMQ    15/1T17              $
       ES     0,1                  $
       SLA    2                    $
4ELNO 3TMQ    6/1T5;32/1T47        $
       EIS    1,4                  $
       TMQ    42/1T47              $
       TMA    AJFAN                $
       EIS    1,4                  $
       TMQ    AJRANGE             $     RANGE AT T29
       FMMR   AJCNV1              $     IN KM OR NM
       FAM    F/.4                $
       TAQ                        $
       JMP    AJFIXIT             $
       SLA    18                  $
       TMQ    16/1T15             $
```

```
        TMD     14/1T29                   $
        JAGD    (P)+1                     $
        JMP     (P)+1                     $
        CA                                 $
        EIS     1,4X                      $
        TMQ     AJCNV2                    $
        FMMA    AJRRATE                   $        10 X RRATE AT
        TAQ                               $
        FMMR    F/10.                     $        IN KM/SEC OR
        FAM     F/.4                      $
        TAQ                               $
        JMP     AJFIXIT                   $
        SLA     11                        $
        TMQ     30/1T29                   $
        TMD     7/1T36                    $
        JAGD    (P)+1                     $
        JMP     (P)+1                     $
        TDA                               $
        EIS     1,4X                      $
        TMD     AJRRATE                   $
        JDP     (P)+3H                    $
        TMD     1/1T37                    $        RR SIGN AT T3
        DORMS   1,4X                      $
        TMQ     F/572.957795              $
        FMMAR   AJELEV                    $        10 X ELEV AT
        FAM     F/.4                      $
        TAQ                               $
        JMP     AJFIXIT                   $
        TMQ     38/1T37                   $
        TMD     10/1T47                   $
        JAGD    (P)+1                     $
        JMP     (P)+1                     $
        TDA                               $
        EIS     1,4X                      $
        TMD     AJELEV                    $        ELEV SIGN
        JDP     (P)+3H                    $        AT T0
        TMD     1/1T0                     $        OF
        DORMS   1,4                        $
        TMD     C/HLT,AJBFFR+128;C/HLT,AJPKITA   $
        AIXJ    2,4X                      $
        SIXOL   128,4X                    $        OUTPUT
        TMD     AJCOL79                   $        ONTO
        TXDLC   0,4X                      $        TAPE
        TDA                               $        (A BLOCK AT A
        AM      D/1                       $        PACKED
        TAM     AJCOL79                   $        PAIRS OF
AJPKFINTMA      N/7T23;N/1T39;H/19T47     $        DATA READY
        JMP     SYS                       $        FOR
        TIO     AJBFFR                    $        TIME
        JMP     SYSNO                     $
        TMD     C/HLT,0;C/HLT,SYSTAB+7    $        ORDERING.

        JMP     SYSIO                     $
        JMP     (P)+2                     $
AJPKITATMD      AJCOL79                   $
```



```
        TXDLC   0,4X                      $
        TDM     AJCOL79                   $        EXIT FOR MORE
        TMD     AJSV34                    $        DATA.
        TDXLC   0,3X                      $
        TDXRC   0,4X                      $
AJPKXX  JMP     (P)                       $
AJNODTA  TIJ    AJND1  $
         TJM    AJDLOOPS
         TIJ    AJADREXS
         TJM    AJCLU+3HS
         TIJ    AJHEDEXS
         TJM    AJHDU+3HS
        JMP     AJDAYSS+1H                $
AJND1   JMP     PANT.SPACE                $
        TMD     AJTYSW                    $
        JDP     (P)+1                     $
        JMP     PANT.TSPACE               $
        TMA     AJNDCW                    $
        JMP     GLOP.GLOP                 $
        TMD     AJTYSW                    $
        JDP     (P)+3H                    $
        JMP     PANT.TPANT                $
        JMP     AJTYEND                   $
        JMP     PANT.ALLFIN               $
        JMP     NXTCASE                    $
AJNDCW  C/HLT,8;C/TIJL,AJNDFW             $
AJNDFW  C/HLT,9+128+8;C/CAM,AJNDAA        $
AJNDAA  A/NO DATAS
*
AJENDPK    JMP  4SUMMRY $
        TIJ     PANT.TPANTA
        TJM     4OUT 1+2H
        JMP     PANT.PAGE
*
          TMA   AJCOL79 $
        TDXLC   0,4X                      $
        TMD     C/HLT,AJBFFR;C/HLT;0      $
        JAED    AJNODTA                   $
        TMD     C/HLT,AJBFFR+128;C/HLT,AJPKITB    $
        AIXJ    0,4X                      $
        JMP     (P)+3                     $
AJPKITBTMD      47/1T47                   $
        TDM     0,4X                      $        WORDS OF
        TDM     1,4X                      $
        AIXOL   2,4X                      $        47 ONES
        JMP     AJPKITB-3H $
        SIXOL   128,4X                    $        FOR
        TMA     AJCOL79                   $        REMAINDER
        AM      D/1                       $
        TAM     AJCOL79                   $        OF BLOCK.
          TIJ   AJPKITCS
          TJM   AJPKITA-1HS
        JMP     AJPKFIN                   $
AJPKITC   TMA   N/7T23;H/8AT47S
          JMP   REWIND $
```

```
         JMP     AJSRTITS
         AFEND   50$
 XSRCH   TJM     XSRCHX
         CM      XSRCH9
         TJM     XSRCH11$
         TXDLC   ,1
         TXDRC   ,2
         TDM     XSRCH1
         TXDLC   ,3
         TXDRC   ,4
         TDM     XSRCH2
         TXDLC   ,5$
         TXDRC   ,6$
         TDM     XSRCH3
         TAD
         TDXRC   ,6
 XSRCHA  TMD     XSRCH2
         TDXLC   ,3
         TMQ     ,6
         TDXRC   ,5
         TMD     XSRCH4
         TDXLC   ,1
         TDXRC   ,4
         ETD     0/177T15$
         SDXL    ,4
         ETD     0/177T8
         TDM     CARD.T4
         ETA     0/7T8
         SRD     7
         JAZ     XSRCHB
 XSRCHC  TDXLC   ,2
         SDXL    ,1
         SDXR    ,3
         ETD     0/17T5
         SRD     10
         ADXL    ,3
         ETA     0/1T41
         JAZ     (P)+2H
         TJM     XSRCH9
         ETA     0/3T23
         SLA     8
         AM      XSRCH10
         TAM     XSRCHF

L XSRCHF HLT
         HLT
         SIXO    2,3
         TMQ     2,3
         TMA     1,3

L        RPTN    6
         SRAQ    ,1
         TQM     XSRCHW$

L        RPTN    6
```



```
         SRAQ    ,2
         TMA     ,3

L        RPTN    6
         SRAQ    ,1
         TQM     XSRCHY$
         TMA     XSRCH4$
         TXDLC   ,4$
         JAGD    XSRCHG$
 XSRCHJ  TMQ     XSRCHW$
         SIXOL   8,4$
         JMP     XSRCHH$
         AIXOL   8,4$
         TMA     XSRCHZ$

L XSRCHE JMP     0$
         JMP     XSRCHD$
         TXDLC   ,4$
         JAED    (P)+2H
         JAGD    (P)+3H$
         TQA     $
         JMP     XSRCHD$
         TQM     1,5$
         TMA     XSRCHW$
 XSRCHD  TAM     ,5$
         TMA     FXERCL$
         JAZ     XSRCHK$
         TMA     XSRCH9$
         JAZ     (P)+2H$
         JMP     (P)+3H$
         AIXO    1,6$
         JMP     XSRCHA$
         TMD     XSRCH1$
         TDXLC   ,1$
         TDXRC   ,2$
         TMD     XSRCH2$
         TDXLC   ,3$
         TDXRC   ,4$
         TMD     XSRCH3$
         TDXLC   ,5$
         TDXRC   ,6$
         TMA     XSRCH11$
 XSRCHX  JMP     0$
 XSRCHG  JAED    XSRCHJ$
         JMP     XSRCHH$
         TQA     $
         TMQ     XSRCHW$
         JMP     XSRCHE$
 XSRCHH  TJM     XSRCHI$
         TMA     XSRCHZ$

L        RPTN    6$
         SLQ     ,4$
L        RPTN    6$
         SRAQ    ,4$
```

$

```
 XSRCHI JMP      0$
 XSRCHK CM       XSRCH11$
        JMP      XSRCHD+3H$

 XSRCH1 $
 XSRCH2 $
 XSRCH3 $
 XSRCH4 C/HLT,8;C/HLT,16$
 XSRCH5 C/HLT,8;C/HLT,1$
 XSRCH6 C/TAM,XSRCHW;C/TMA,XSRCH4$
 XSRCH7 C/JMP,FXINT;C/JMP,XSRCHD$
 XSRCH8 C/JMP,FXFLT;C/JMP,XSRCHD$
 XSRCH9 $
 XSRCH10C/TMD,XSRCH6;C/TDM,XSRCHE$
 XSRCH11$
 XSRCHB TMD      XSRCH5$
        JMP      XSRCHC$
 XSRCHW $
 XSRCHY $
 XSRCHZ W/           $
E       AFEND    $
 AJSRTIT TMA     AJCOL79         $
        TDM      AJCNV1$
        SLA      32                        $        DETERMINE
        TIXZ     1,1X                      $        NUMBER
        SM       AJNMBLK                   $        OF TAPE
        JAZ      (P)+4H                    $        READS
        JAN      (P)+3H                    $        REQUIRED.
        AIXOL    1,1X                      $
        JMP      (P)-2                     $
        AM       AJNMBLK                   $        XR1= N TIMES
        TAM      AJLSTBK                   $        AJNMBLK=MAX,C
        CD                                 $        AJLSTBK=LAST
        TXDLC    0,1X                      $
        TDM      AJSVXR1                   $
        SCD      33                        $
        JDP      (P)+1                     $
        JMP      (P)+1                     $
        CSMS     AJCNV1                    $        TAPE ALTERNAT
        TMD      C/HLT,1;C/HLT,AJSRTA      $
        AIXJ     0,1X                      $
        TMD      AJLSTBK                   $
        JMP      (P)+1                     $
 AJSRTA TMD      AJNMBLK                   $
        TDM      AJCMNBK                   $
        TMD      C/HLT,AJBFFR;C/HLT,AJBFFX$         SET UP
        TDXLC    0,5X                      $        INPUT AND
        TDXRC    0,6X                      $        OUTPUT BUFFER
          TMA    N/8T23;H/8AT47 $
          JMP    REWIND         $
          TMA    N/9T23;H/8AT47 $
          JMP    REWIND         $
 AJSRTB JMP      AJRD7                     $        READ AND
        JMP      AJMERGE                   $        MERGE,IF REQ.
        TMD      C/HLT,0;C/HLT,AJSRTC      $
```



```
            SIXJ     1,1X                 $        IS MERGE ALL
              TMA    N/7T23;H/8AT47 $
              JMP    REWIND         $
            JMP      AJCNGTM-3H             $
   AJSRTC   TMD      C/HLT,1;C/HLT,AJSRTB $        NO,IS IT ONE
            SIXJ     0,1X                 $        NO,CONTINUE
            TMD      AJLSTBK              $        YES,SET UP FO
            TDM      AJCMNBK              $        PARTIAL CORE,
            JMP      AJSRTB               $
            TMD      AJSVXR1              $
            TDXLC    0,3X                 $
            CM       AJMRGSW                $
   AJCNGTMTMD        C/HLT,1;C/HLT,AJSRTD $        PROCESS TAPE
            AIXJ     0,3X                 $        FOR PROPER
            CSM      AJLSTBK              $        TIME FORMAT,
            TAM      AJMRGSW              $        AJMRGSW=
            TMD      AJLSTBK              $        -,PARTIAL COR
            JMP      (P)+1                $        +,FULL AND/OR
   AJSRTD   TMD      AJNMBLK              $          CORE.
            TDM      AJCMNBK              $
            TDXLC    0,4X                 $
              TMD    4LMAX          $
            TDXLC    0,5X                 $        IN
            TMA      N/8T23;N/1T39;H/91T47 $       TAPE
            JMP      SYS                  $
            TIO      0,5X                 $        8.
            JMP      SYSNO                $
            TMD      C/HLT,0;C/HLT,SYSTAB+8 $
            JMP      SYSIO                $
            AIXOL    128,5X               $
            TMD      C/HLT,0;C/HLT,AJSRTD+5H $
            SIXJ     1,4X                 $
            TMD      AJMRGSW              $        IF PARTIAL

L           JDP      (P)+8H                 $
            SIXOL    128,5X               $        LENGTH BY
            TMA      47/1T47              $        SENTINEL SEAR
R           RPTAN    64                   $
            TMD      2,5X                 $
            JAED     (P)+2H                 $
            AIXOL    2,5                    $
            SIXOL    2,5X                 $
            CD                            $
            TXDRC    0,5X                 $
            TDA                           $
              SM     4RMAX          $
            SRA      1                    $        COMMAND WORD
              AM     4LMAX          $
L  AJLEAP   TAM      AJSVSV               $        ADDR.(T15);NO
            SIXOL    2,5X                 $
   AJINSMRJMP        (P)+1H   $
            TMQ      23/1T22                $
            ETA      0,5X                 $        EXTRACT FROM
            TAQ                           $        EACH PAIR (IN
            CA                            $                   OR
```

```
          SRQ      25                                $
          DAQ      D/144000                          $         CONVERT TO
          SLQ      42                                $
          TQM      AJSV34                            $         DAYS ELAPSED.
          TAQ                                        $
          CA                                         $
          DAQ      D/6000                            $
          SLQ      37                                $
          TQM      AJHR                              $         HOURS.
          TAQ                                        $
          CA                                         $
          DAQ      D/100                             $
          SLQ      31                                $
          TQM      AJMIN                             $         MINUTES.
          SLA      24                                $         FRACMIN.
          TMQ      6/1T16                            $
          EI       AJMIN                             $         REINSERT
          SLQ      6                                 $         IN FORM.
          EI       AJHR                              $         DAYS ELAPSED
          SLQ      5                                 $         HOURS AT T10
          EI       AJSV34                            $         MIN   AT T16
          SLA      1                                  $
          TMQ      25/1T47                            $
          EIS      0,5X                              $
            TMD    4LMAX2               $
            SIXO   2,5                  $
            JNO    AJINSMR              $
   AJLEAPDTMD      AJSVSV                            $         JUMP TO FINAL
          TDXLC    0,4X                              $         OUTPUT PHASE
          TDXRC    0,5X                              $         PUT OUT HARDC
          TMA      CONTG                             $
          JAZ      (P)+1                             $
          JMP      AJSATST                           $
          JMP      AJOUTPT                           $         AND TTY(IF RE
   AJCTAGNTMD      C/HLT,0;C/HLT,AJCNGTM             $         CONTINUE
          SIXJ     1,3X                              $         OR
          TMA      CONTG                             $
          JAZ      (P)+1                             $
          JMP      AJGRPIT                           $
          JMP      PANT.FINISH$                             FINISH    AJJ K=1
            JMP    NXTCASE                $
L  AJT8CD N/8T23;N/1T39;H/91T47                      $         READ T8
          C/HLT,0;C/HLT,SYSTAB+8                     $         AND
          N/9T23;N/1T39;H/19T47                      $         WRITE 9
          C/HLT,0;C/HLT,SYSTAB+9                     $
   AJT9CD N/9T23;N/1T39;H/91T47                      $         READ 9
          C/HLT,0;C/HLT,SYSTAB+9                     $         AND
          N/8T23;N/1T39;H/19T47                      $         WRITE T8.
          C/HLT,0;C/HLT,SYSTAB+8                     $
   AJMRCW1$                                                    READ
   AJMRCW2$                                                    AND
   AJMRCW3$                                                    WRITE
   AJMRCW4$                                                    COMMANDS.
   AJMERGETJM      AJMRGX                            $
          TMA      AJCNV1                            $         MERGE
```



```
          TMD      C/HLT,AJT8CD;C/HLT,AJMRCW1            $TAPE
          JAN      (P)+1                        $         ALTERNATOR.
          TMD      C/HLT,AJT9CD;C/HLT,AJMRCW1            $
          TDXLC    0,2X                         $
          TDXRC    0,3X                         $
R         RPTAA    4                            $         SET
          TMD      1,2X                         $         UP
          TDM      1,3X                         $         MERGE
            TMD    4LMAX            $
          TDXLC    0,2X                         $         EBLOC.
          TMD      AJCMNBK                      $         LENGTH OF
          SCD      41                           $         USABLE
          TDXLC    0,3X                         $         CORE,
          TMD      AJDNCNT                      $         AND
          TDXLC    0,4X                         $         BLOCKS ON TAP
          TMD      C/HLT,0;C/HLT,AJMRGIT-1H     $
          AIXJ     0,4X                         $
          JMP      AJCORTT                      $
          JMP      AJRD89                       $
   AJMRGITTMQ      47/1T47                      $
          ETA      0,5X                         $         COMPARE
          ETD      0,2X                         $         TAPE AND
          JAGD     AJMRGA+1                     $         CORE.
          TMD      0,5X                         $         XR2=CORE ADDR
          TDM      0,6X                         $         XR3=CORE WORD
          TMD      1,5X                         $         XR4=NO.BLOCK
          TDM      1,6X                         $         XR5=OLD TAPE
          TMD      C/HLT,AJBFFR+128;C/HLT,AJCK6X        $XR6=NEW TAPE
          AIXJ     2,5X                         $
          SIXOL    128,5X$
          TMD      C/HLT,0;C/HLT,AJMRGA         $
          SIXJ     1,4X                         $
          TDM      AJMRGSW                      $         AJMRGSW
          JMP      AJCK6X                       $         =0 ,CONTINUE
   AJMRGA JMP      AJRD89                       $         =+ ,OLD TAPE
          JMP      AJCK6X                       $         =- ,CORE DONE
          TMD      0,2X                         $
          TDM      0,6X                         $
          TMD      1,2X                         $
          TDM      1,6X                         $         EMPTY NEW TAP
          AIXOL    2,2X                         $         BUFFER AS REQ
          TMD      C/HLT,0;C/HLT,AJCK6X         $         ONTO TAPE.
          SIXJ     2,3X                         $
          TMD      30/1T29                      $
          TDM      AJMRGSW                      $
   AJCK6X TMD      C/HLT,AJBFFX+128;C/HLT,AJMRGB        $
          AIXJ     2,6X                         $
          SIXOL    128,6X                       $
          JMP      AJWT89                       $
   AJMRGB TMA      AJMRGSW                      $
          JAZ      AJMRGIT                      $
          JAN      AJDOTPE                      $

R  AJDOCORRPTAA    2                            $         IF OLD TAPE D
          TMD      1,2X                         $         PROCESS
```

```
         TDM     1,6X                           $        REMAINDER OF
         SIXOL   2,3X                           $
         TMD     C/HLT,AJBFFX+128;C/HLT,AJDOCOR   SCORE DATA
         AIXJ    0,6X                           $         ONTO
         SIXOL   128,6X                         $         NEW TAPE.
         JMP     AJWT89                         $
         TMD     C/HLT,0;C/HLT,AJCORTT          $
         SIXJ    0,3X                           $
         JMP     AJREWTP                        $
 AJCORTTTMD      C/JMP,SYS;C/TIO,0,2X           $
         TDM     AJWT89+1                       $
         CD                                     $
         TXDLC   0,3X                           $
         SRD     7                              $
         TDXLC   0,3X                           $
 AJMRGC  JMP     AJWT89                         $
         AIXOL   128,2X                         $
         TMD     C/HLT,0;C/HLT,AJMRGC           $
         SIXJ    1,3X                           $
         TMD     C/JMP,SYS;C/TIO,AJBFFX$
         TDM     AJWT89+1                       $
         JMP     AJREWTP                        $         IF CORE DONE.
R AJDOTPERPTAA   2$
         TMD     1,5X                           $         REMAINDER
         TDM     1,6X                           $         OF TAPE DATA
         TMD     C/HLT,AJBFFX+128;C/HLT,AJDOTPE   $ONTO
         AIXJ    0,6X                           $         NEW TAPE.
         SIXOL   128,6X                         $
         SIXOL   128,5X                         $
         JMP     AJWT89                         $
         TMD     C/HLT,0;C/HLT,AJTAPTT          $
         SIXJ    1,4X                           $
         JMP     AJREWTP                        $
 AJTAPTTTMD      C/JMP,SYS;C/TIO,AJBFFX         $
         TDM     AJRD89+1                       $
         JMP     AJRD89                         $
         JMP     AJWT89                         $
         TMD     C/HLT,0;C/HLT,AJTAPTT+1        $
         SIXJ    1,4X                           $         REWIND
         TMD     C/JMP,SYS;C/TIO,AJBFFR         $         OLD AND
         TDM     AJRD89+1                       $         NEW TAPE.
 AJREWTPTMA      C/HLT,0;C/HLT,SYSTAB+8         $
            TMA     N/8T23;H/8AT47  $
            JMP     REWIND          $
            TMA     N/9T23;H/8AT47  $
            JMP     REWIND          $
         TMA     AJCMNBK                        $
         AMS     AJDNCNT                        $         UPDATE BLOCK
         CSMS    AJCNV1                         $         SWITCH ALTERN
         CM      AJMRGSW                        $         CLEAR MERGE S
 AJMRGX  JMP     (P)                            $
L AJRD89 TJM     AJRDINX                        $
         TMA     AJMRCW1                        $         TAPE
         JMP     SYS                            $         READ.
         TIO     AJBFFR                         $
```



```
         JMP     SYSNO                          $
         TMD     AJMRCW2                        $
         JMP     SYSIO                          $
  AJRDINXJMP     (P)                            $
L AJWT89 TJM     AJWTX                          $
         TMA     AJMRCW3                        $         TAPE
         JMP     SYS                            $         WRITE.
         TIO     AJBFFX                         $
         JMP     SYSNO                          $
         TMD     AJMRCW4                        $
         JMP     SYSIO                          $
  AJWTX  JMP     (P)                            $
  AJRD7  TJM     AJRD7X                         $
           TMD   4LMAX              $
         TDXLC   0,2X                           $         IN
         TMD     AJCMNBK                        $         RAW
         TDXLC   0,3X                           $         DATA
  AJRD7A TMA     N/7T23;N/1T39;H/91T47          $         FROM
         JMP     SYS                            $         TAPE 7.
         TIO     0,2X                           $         FILLING
         JMP     SYSNO                          $         UP AS
         TMD     C/HLT,0;C/HLT,SYSTAB+7         $         MUCH CORE
         JMP     SYSIO                          $         AS
         AIXOL   128,2X                         $         REQUIRED
         TMD     C/HLT,0;C/HLT,AJRD7A           $         OR
         SIXJ    1,3X                           $         POSSIBLE.
         TMA     AJCMNBK                        $         SORT
         SLA     7                               $
         AM      4LMAX                           $
         SRA     24                              $
         AM      4LMAX                           $
         JMP     SORT.SORT                       $
*                                                $
  AJRD7X JMP     (P)                            $
  AJOUTPTTJM     AJFINAL                        $
         CD      $
         TXDLC   0,3X                           $
         TDM     AJSV34                         $
  AJ1OUT JMP     AJDAYSS                         $
L AJDAYSSJMP     AJDAYEL                        $
         TMD     D/1                            $
         TDM     AJPAGES                        $         INITIALIZE
         TMA     CLSFY                          $         PAGE COUNT.
         AM      L/AJACN                        $         FETCH PROPER
         TAD                                    $         CLASSIFICATIO
         TDXRC   0,6X                           $         AND
         TMD     0,6X                           $         STORE
         TDM     AJHDCY                         $         FOR
         TDM     AJTYCL                         $         OUTPUT.
         TMA     NOTTY                          $
         JAZ     AJTTY                          $
         CM      AJTYSW                         $         AJTYSW=+,NO T
         JMP     (P)+3H                         $               =-,TTY.
  AJTTY  CSM     N/1T47                         $
         TAM     AJTYSW                         $
```

```
          CD                                $
          TDXLC    0,6X                     $
          TDXRC    0,7X                     $
          TIJ      AJCONT                    $
          TJM      AJ1OUT                    $
          TMD      AJTYSW                   $
          JDP      (P)+1                    $         IF REQUESTED,
          JMP      AJADR                    $         TTY HEADING,
          JMP      AJHEAD                   $         HD COPY HDG.

L AJDLOOPJMP       AJDYCK                   $         CHECK
          TMD      AJSMDAY                  $         DAY ELAPSED
          JDP      AJG01                    $
          TMA      AJCWJ                    $         IF NEW,
          JMP      GLOP.GLOP                $         OUTPUT
          TMD      AJTYSW                   $         TTY AND/OR
          JDP      AJGO                     $         HD COPY,
          JMP      PANT.TPANT               $
  AJLOOP  TMD      C/HLT,99;C/HLT,AJGO      $         CHECK
          AIXJ     1,7X                     $         TTY LINE COUN
          JMP      AJTYEND                  $         CONTINUE OR
          SIXOL    99,7X                    $         RESET
          AFEND    80                        $
          JMP      PANT.PAGE
          TMA      AJPAGE
          JMP      GLOP.GLOP
          TMA      D/1$
          AMS      AJPAGES
          JMP      AJADR
          TIXZ     10,6
          TIJ      AJGOA
          TJM      AJHEDEX
          JMP      AJHDCY
  AJGO    TMD      C/HLT,54;C/HLT,AJGOA     $         CHECK
          AIXJ     1,6X                     $         HD COPY LINE
          SIXOL    54,6X                    $         CONTINUE OR
          JMP      AJHEAD                   $         RESET.
  AJGOA   JMP      AJDLOOP                  $
  AJG01   TMQ      5/1T9                     $
          ETA      0,4X                     $         EXTRACT
          SRA      1                         $
          TAM      AJHR                     $         HOURS.
          TMD      N/10T10                  $
          JAGD     (P)+3                    $
          TMD      C/HLT,15*128+ 2;C/TMA,AJHR       $
          TDM      AJFWL2                   $
          SRA      1                        $
          TAM      AJHR                     $
          JMP      (P)+3H                   $
          TMD      C/TCM,15*128+37;C/TMA,AJHR       $
          TDM      AJFWL2                   $
          TMQ      6/1T15                    $
          ETA      0,4X                     $
          SRA      1                         $
          TAM      AJMIN                    $         MINUTES,
```



```
          TMD      N/10T16                  $
          JAGD     (P)+3                    $
          TMD      C/HLT,17*128+ 2;C/TMA,AJMIN    $
          TDM      AJFWL3                   $
          SLA      5                        $
          TAM      AJMIN                    $
          JMP      (P)+3H                   $
          TMD      C/TCM,17*128+31;C/TMA,AJMIN    $
          TDM      AJFWL3                   $
          TMQ      7/1T22                    $
          ETA      0,4X                     $
          SRA      1                         $
          TAM      AJFRMIN                  $
          TMD      N/10T23                  $
          JAGD     (P)+3                    $
          TMD      C/HLT,20*128+ 2;C/TMA,AJFRMIN $
          TDM      AJFWL5                   $
          SLA      12                       $
          TAM      AJFRMIN                   $
          JMP      (P)+3H                   $
          TMD      C/TCM,20*128+24;C/TMA,AJFRMIN $
          TDM      AJFWL5                   $
          TMQ      12/1T34                   $
          ETD      0,4                       $
          SRD      5                         $
          TDA      $
          AM       C/HLT,0;C/HLT,SATNOS$
          TMQ      24/1;16/0;8/1$
          EIS      SATRT$
          EIS      SATRT1                    $
L SATRT1  TMQ      15/1T17                   $
          ETA      (P)                       $
          SLA      2                         $
          TMQ      10/1T15                   $
          EA       1,4                       $
          TAM      AJREV                     $
          TMA      4C4+2                     $
          JAZ      (P)+3H                    $
          ETD      1,4                       $
          TDM      AJREV                     $
L SATRT   TMQ      18/1T47$
          ETA      (P)                       $
          TDM      AJSAT$                               XXX00000
          JMP      BINBCD                    $
          TMD      BCDSAT                    $
          SCD      30                        $
          TDM      AJSAT1$
          TMQ      12/1T46                   $
          ETA      0,4X                     $
          SLA      16                       $
          TMQ      F/107374182.4            $
          FMAR                              $
          FAM      F/.04                    $
          TAM      AJAZ                     $          FL.PT.AZ,
          TMQ      5/1T5                     $
```

```
         ETA     1,4                        $
         SRA     10                         $
         AM      C/TMD,FNOTAB;C/TDM,FANNO   $
         TAM     (P)+1                      $

L        NOP                                $
         NOP                                $
         TMQ     ELFLAG                     $
         JQO     (P)+3H                     $
         TMD     W/                         $
         TDM     FANNO                      $
         TMQ     14/1T29                    $
         ETD     1,4X                       $
         TDM     AJRANGE                    $    RANGE.
         TMQ     7/1T36                     $
         ETA     1,4X                       $
         SLA     6                          $
         TMQ     F/107374182.4              $
         FMAR                               $
         FAM     F/.04                      $
         TAM     AJRRATE                    $    FL.PT.R-RATE.
         TMQ     1/1T37                     $
         ETA     1,4X                       $    (CHECK
         JAZ     (P)+1                      $     POS. OR
         FCSMS   AJRRATE                    $     NEG.)
         TMQ     10/1T47                    $
         ETA     1,4X                       $     OR
         SLA     17                         $
         TMQ     F/107374182.4              $
         FMAR                               $
         FAM     F/.04                      $
         TAM     AJELEV                     $    FL.PT.ELEV.
         TMD     1,4                        $
         JDP     (P)+1                      $
         FCSMS   AJELEV                     $
         TMA     DRCOSFL                    $
         JAZ     BYPASS1                    $
         TMA     AJAZ                       $
         FSM     F/.04                      $
         TAQ                                $
         TMA     AJELEV                     $
         JAP     (P)+3H                     $
         FAM     F/.04                      $
         JMP     (P)+2H                     $
         FSM     F/.04                      $
         JMP     COMPL                      $
         TDM     TEMP1                      $
         TJM     TEMP2                      $
         TAM     TEMP3                      $
         TMA     XFX                        $
         TMQ     XFY                        $
         TMD     XFZ                        $
         JMP     DOTPR                      $
         FAM     F/.0005                    $
         JAP     (P)+2H                     $
```



```
         FSM     F/.0010                    $
         TAM     RSV                        $
         TMA     ZFX                        $
         TMQ     ZFY                        $
         TMD     ZFZ                        $
         JMP     DOTPR                      $
         FAM     F/.0005                    $
         JAP     (P)+2H                     $
         FSM     F/.0010                    $
         TAM     RSU                        $
         TMA     YFX                        $
         TMQ     YFY                        $
         TMD     YFZ                        $
         JMP     DOTPR                      $
         FAM     F/.0005                    $
         JAP     (P)+2H                     $
         FSM     F/.0010                    $
         TAM     RSW                        $
BYPASS1  TMA     AJCHL                      $
         JMP     GLOP.GLOP                  $
         TMD     AJTYSW                     $
         JDP     (P)+10H                    $
         TMA     0/32;42/1                  $
         TMQ     42/1T47                    $
         TMD     ELFLAG                     $
         SCD     1                          $
         JDP     (P)+2H                     $
         SRAQ    36                         $
         TMD     LOCGB                      $
         TDXLC   ,1                         $
         EIS     6,1                        $
         JMP     PANT.TPANT                 $
         AIXOL   2,4X                       $
         TMD     C/HLT,0;C/HLT,AJCONT       $    DECREMENT AND
         SIXJ    1,5X                       $    CHECK COUNT.
         TMD     AJMRGSW                    $
         JDP     LOAD3X                     $
         TMD     A/NO MORE $
         TDM     AJMRDTA                    $
         TMA     AJCWMR                     $
         JMP     GLOP.GLOP                  $
         TMA     CLSFY                      $         CN-T350
         JAZ     (P)+3H                     $         CN-T350
         TMA     JSGP                       $         CN-T350
         JMP     GLOP.GLOP                  $         CN-T350
         TMD     AJTYSW                     $    IF DONE
         JDP     (P)+1                      $    FINISH
         JMP     AJTYEND                    $    UP AND
LOAD3X   TMD     AJSV34                     $
         TDXLC   0,3X                       $
AJFINAL  JMP     (P)                        $    EXIT.
AJCONT   TMD     AJTYSW                     $    OR
         JDP     (P)+1                      $    RETURN FOR
         JMP     AJLOOP                     $    NEXT
         JMP     AJGO                       $    DATA.
```

```
 AJDAYELTJM     AJDEXS                                  INITIAL ENTRY
        TMQ     5/1T4                          $
        ETA     0,4XS                                   EXTRACT
        SRA     1                              $
 AJPRO  TAM     AJDEPRES                                DAYS
        SRA     10S                                     ELAPSED,
        TAO     S                                       ADD
        FMMR    F/32768S                                TO
        FAM     FDAYS                                   FDAY
        TAM     AJDAYS                                  AND
        JMP     FYKLOKS                                 ENTER
        CSM     D/1S
        TAM     AJSMDAYS
        JMP     AJFIXIT                        $
        TAM     AJDDDS                                  SET
        TMA     AJDAYS                                  AJSMDAY
        JMP     DKLOKS                                  SWITCH
        TAM     AJDATES                                 NEGATIVE.
        TAO                                    $        ALSO
        SRA     12                             $        SAVE
        SLQ     6                              $        IN
        SRAQ    12                             $        AJDEPRE
        TMA     AJDATE                         $        CURRENT
        SLA     6                              $        DAYS
        SLAQ    30                             $        ELAPSED.
        AM      O/61T17;0/01T35                $
        TAM     AJDATE                         $
 AJDEX  JMP     (P)S                                    EXIT.
 AJDYCK TJM     AJDEXS                                  NEW DATA ENTR
        TMQ     5/1T4                          $
        ETA     0,4XS                                   NEW AND OLD
        SRA     1                              $
        TMD     AJDEPRES                                DAY ELAPSED.
        JAED    (P)+1S                                  IF DIFFERENT,
        JMP     AJPROS                                  AJPRO TO COMP
        CM      AJSMDAYS                                IF SAME, CLEA
        JMP     AJDEXS                                  AJSMDAY SWITC
 AJHEAD TJM     AJHEDEX                        $        HARDCOPY HEAD
        JMP     PANT.PAGE                      $
        TMA     AJPAGE                         $        PAGE NUMBER
        JMP     GLOP.GLOP                      $
        TMA     AJPAGES                        $        CLASSIFICATIO
        AM      D/1                            $
        TAM     AJPAGES                        $        LOOK ANGLE...

L AJHDCY NOP                                   $

L       JMP     GLOP.GLOP                      $        DAY
        TMA     AJCWI                          $
        JMP     GLOP.GLOP                      $        SAT.........R-
        JMP     PANT.SPACE                     $
        TMA     C/HLT,10;C/HLT,AJLN12           $
        JMP     PANT                            $
L AJHDJ TMD     C/HLT,77*128+44;C/CAM,AJUNITSS
        TDM     AJFWJ3                         $
```



```
        TMA     AJCWJ                         $
        JMP     GLOP.GLOP                     $        AND
        TMD     C/HLT,24*128+1;C/CAM,AJCRLF        $
        TDM     AJFWJ3                        $
        AIXOL   5,6X                          $        SPACE;
 AJHEDEXJMP     (P)                           $
*
*
        S
        S
 AJADR  TJM     AJADREX S
        TMD     AJADR-1 S
        TXDLC   ,0  S
        TXDLC   ,1  S
        TDM     AJADR-1 S
        TXDLC   ,2
        TDM     AJADR-2 S
        JMP     4HEAD     S
        TMD     AJADR-1 S
        TDXLC   ,0 S
        TDXRC   ,1 S
        TMD     AJADR-2 S
        TDXLC   ,2
*
*
 AJNOADRTMA     AJCWH                         $
        JMP     GLOP.GLOPS                              AJJ  T-205
        JMP     PANT.TPANTS                             AJJ  T-205
L AJTYCL NOP                                  $        AND

L       JMP     GLOP.TGLOP                    $
        TMA     AJCWI                         $        A
        JMP     GLOP.TGLOP                    $
        JMP     PANT.TSPACE                   $
        TMA     C/HLT,10;C/HLT,AJLN12          $
        JMP     PANT.TPANTA                    $
L AJCLU TMD     C/HLT,77*128+44;C/CAM,AJUNITSS
        TDM     AJFWJ3                        $
        TMA     AJCWJ                         $        LINE
        JMP     GLOP.TGLOP                    $
        TMD     C/HLT,24*128+1;C/CAM,AJCRLF        $
        TDM     AJFWJ3                        $
        TIXZ    5,7
 AJADREXJMP     (P)                           $
 AJTYENDTJM     AJTNEX                        $        WRAP-UP
        TMA     AJCWMR                        $
        JMP     GLOP.TGLOP                    $
        TMA     CLSFY
        JAZ     JSTYEND
        TMA     JSGP
        JMP     GLOP.TGLOP
 JSTYENDTMA     AJCWH
        JMP     GLOP.GLOPS                              AJJ  T-205
        JMP     PANT.TPANTS                             AJJ  T-205
*
```

```
*
*
        TMA     C/HLT,7;C/NOP,0         $       AND
        JMP     PANT.TSPACER            $
        TMA     AJCWNN                  $
        JMP     GLOP.TGLOP              $       12 INCHES
        TMA     AJCWLC                  $          OF
        JMP     GLOP.TGLOP              $       LETTER CHARAC
        JMP     PANT.TTYCSS                        AJ.I K-135
AJTNEX  JMP     (P)                     $
AJFIXITTJM      AJFXEXT                 $       FIX FLT.PT.
        ETD     12/1T47                  $
        CA                               $
        SCD     12                       $
        JDP     (P)+2H                   $
        JMP     AJFXEXT                  $
        SRD     4                        $
        TDXLC   .2                       $
        SLAQ    1.2                      $
*                                        $
AJFXEXTJMP      (P)                     $       EXIT.
AJGRPIT  TMA    N/7T23;H/8AT47 $
         JMP    REWIND         $
         TMA    N/8T23;H/8AT47 $
         JMP    REWIND         $
        TMD     AJSVXR1                 $
        TDXLC   0.3X                    $
        TMD     C/HLT,AJBFFR            $
        TDXLC   0,4X                    $
AJGRPA  TMD     C/HLT,1;C/HLT,AJGRPB    $               INITI
        AIXJ    0,3X                    $
        TMA     AJLSTBK                 $               AND
        JMP     (P)+1                   $
AJGRPB  TMA     AJNMBLK                 $               READ
        TDXLC   0,7X                    $
        SLA     7$
         AM     4LMAX           $
        TDXLC   0,6X                    $               INTO
        TAM     AJCKEND                 $
AJGRPC  TMA     N/7T23;N/1T39;H/91T47   $
        JMP     SYS                     $               EBLOC
        TIO     0,6X                    $
        JMP     SYSNO                   $
        TMD     C/HLT,0;C/HLT,SYSTAB+7  $
        JMP     SYSIO                   $
        AIXOL   128,6X                  $
        TMD     C/HLT,0;C/HLT,AJGRPC    $
        SIXJ    1,7X                    $
        TMD     4LMAX           $
        TDXLC   0,6X                    $
        TIXZ    0,7X                    $
AJGRPD  TMA     0,6X                    $
        TMD     47/1T47                 $               IF SE
        JAED    AJGFIN                  $               FINIS
        CD                              $
```



```
        JAED    AJCLRLC                 $               SKIP
        TMQ     1/1T47                  $               LOC,
        ETA     0,6X                    $
        JAEQ    (P)+1                   $               IF LA
        JMP     (P)+3H                  $               FOR T
        JMP     AJWTBF8                 $               AND S
        JMP     AJCLRLC                 $               AND G
        TMQ     12/1T34                  $
        ETD     0,6                      $
        SRD     5                        $
        TDA     $
        AM      C/HLT,0;C/HLT,SATNOS$
        TMQ     24/1;16/0;8/1$
        EIS     FJAMS$
L FJAMS TMQ     18/1T47$
        ETD     (P)$
        TDM     AJSATS$                         XXX00000
        TXDLC   0,6X                    $               REMAI
        TDM     AJSV56                  $               POINT
        JMP     AJWTBF8                 $
AJGRPE  AIXOL   2,6X                    $
        TMA     AJCKEND                 $               IF AT
        TXDLC   0,6X                    $               OF EB
        JAED    AJSCHBF                 $               ON TA
        TMA     0,6
        JAZ     AJGRPE
        TMQ     12/1T34                  $
        ETD     0,6                      $
        SRD     5                        $
        TDA     $
        AM      C/HLT,0;C/HLT,SATNOS$
        TMQ     24/1;16/0;8/1$
        EIS     AMFJS$
L AMFJS TMQ     18/1T47$
        ETA     (P)$
        ETD     AJSATS$
        JAED    (P)+1                   $               EBLOC
        JMP     AJGRPE                  $               SEARC
        TMQ     1/1T47                  $
        ETA     0,6X                    $
        JAEQ    (P)+1                   $
        JMP     (P)+3H                  $
        JMP     AJWTBF8                 $
        JMP     AJGRPX                  $
        JMP     AJWTBF8                 $
        JMP     AJGRPE                  $
AJGRPX  TMD     AJSV56                  $
        TDXLC   0,6X                    $
AJCLRLCAIXOL    2,6X                    $               CHECK
        TMA     AJCKEND                 $               END O
        TXDLC   0,6X                    $               EBLOC
        JAED    (P)+1                   $
        JMP     AJGRPD                  $
        SIXOL   1,3X                    $
```

```
         JMP    AJGRPA                  $                  
 AJGFIN  TMD    47/1T47                 $                   FINIS
         TDM    0,4X                    $                   TRANS
         TDM    1,4X                    $                   INFO
         TMD    C/HLT,AJBFFR+128;C/HLT,AJGFINS
         AIXJ   2,4X                    $                   AND
         SIXOL  128,4X                  $                   CLEAR
         JMP    AJWTBUF                 $                   NON-I
         CM     CONTG                   $                   SWITC
           TMA  N/8T23;H/8AT47 $
           JMP  REWIND            $
         TIJ    AJLEAPD $
         TJM    AJINSMR $
         JMP    AJCNGTM-3H                $
 AJSCHBFTMA     N/7T23;N/1T39;H/91T47   $                   TAPE
         JMP    AJTP7                   $                   SEARC
         AIXOL  1,7X                    $                   FOR
         TMA    N/1T15;N/7T23;H/D1T47   $                   DATA
         JMP    AJTP7                   $                   OF
         TMD    C/HLT,AJBFFX            $                   REMAI
 AJSCHBGTDXLC   0,6X                    $                   POINT
         TMQ    12/1T34                   $
         ETD    0,6                       $
         SRD    5                         $
         TDA    $
         AM     C/HLT,0;C/HLT,SATNOS$
         TMQ    24/1;16/0;8/1$
         EIS    FJAMS1$

L FJAMS1 TMQ    18/1T47$
         ETA    (P)$
         ETD    AJSATS
         JAED   AJSCHBH                 $                   AND
 AJSCHBDTMD     C/HLT,AJBFFX+128;C/HLT,AJSCHBG+1H$         REV
         AIXJ   2,6X                    $
         SIXOL  128,6X                  $
         TMA    N/7T23;N/1T39;H/19T47   $
         JMP    AJTP7                   $
         JMP    AJSCHBF                 $
 AJSCHBHTMQ     1/1T47                  $
         ETA    0,6X                    $

         JAEQ   (P)+1                   $
         JMP    AJSCHBK                 $
         JMP    AJWTBF8                 $
         TMA    N/7T23;N/1T39;H/19T47   $
         JMP    AJTP7                   $
 AJSCHBITMD     C/HLT,0;C/HLT,AJSCHBJ   $                   RESTO
         SIXJ   0,7X                    $                   7 TO
         JMP    AJGRPX                  $                   POSIT
 AJSCHBJTMA     N/1T15;N/7T23;H/D1T47   $                   PRIOR
         JMP    AJTP7                   $                   TO
         SIXOL  1,7X                    $                   SEARC
         JMP    AJSCHBI                 $
 AJSCHBKJMP     AJWTBF8                 $
```



```
         JMP    AJSCHBD                 $
 AJTP7   TJM    AJTP7XX                 $                   TAPE
         JMP    SYS                     $                   READ
         TIO    AJBFFX                  $                   OR
         JMP    SYSNO                   $                   WRITE
         TMD    C/HLT,0;C/HLT,SYSTAB+7  $                   OR
         JMP    SYSIO                   $                   SPACE
 AJTP7XXJMP     (P)                     $
 AJWTBF8TJM     AJBF8XX                 $                   TRANS
         TMD    0,6X                    $                   BUFFE
         TDM    0,4X                    $                   OF
         TMD    1,6X                    $                   INFO
         TDM    1,4X                    $                   FROM
         CM     0,6X                    $                   EBLOC
         TMD    C/HLT,AJBFFR+128;C/HLT,AJBF8XX    $         TO
         AIXJ   2,4X                    $                   TAPE
         JMP    AJWTBUF                 $
         SIXOL  128,4X                  $
 AJBF8XXJMP     (P)                     $
 AJWTBUFTJM     AJWBXX                  $                   ROUTI
         TMA    N/8T23;N/1T39;H/19T47   $                   TO
         JMP    SYS                     $                   COPY
         TIO    AJBFFR                  $                   ONTO
         JMP    SYSNO                   $                   TAPE
         TMD    C/HLT,0;C/HLT,SYSTAB+8  $
         JMP    SYSIO                   $
 AJWBXX JMP     (P)                     $
 AJSATSTTMD     AJCMNBK                 $                   NO
         TDXLC  0,4X                    $                   SATEL
           TMD  4LMAX            $
         TDXLC  0,5X                    $
         TMA    N/7T23;N/1T39;H/19T47   $                   THERE
         JMP    SYS                     $                   RATHE
         TIO    0,5X                    $                   THAN
         JMP    SYSNO                   $                   OUTPU
         TMD    C/HLT,0;C/HLT,SYSTAB+7  $                   STORE
         JMP    SYSIO                   $                   INFO
         AIXOL  128,5X                  $                   ON
         TMD    C/HLT,0;C/HLT,AJSATST+2 $                   SCRAT
         SIXJ   1,4X                    $                   TAPE.
         JMP    AJCTAGN                 $
 JSGP    C/HLT,0;C/TIJL,JSGP1
 JSGP1   C/HLT,5+128+5;C/CAM,JSGP2
E        AFEND                            $
 JSGP2   A/GP=3;0/32323232$
 AJCWH   C/HLT,     0;C/TIJL,AJFWH  $             LINE 8
 AJUNC   C/HLT,     0;C/TIJL,AJFCL          $    LINE 9 UNCLAS
 AJCONF  C/HLT,     0;C/TIJL,AJFCF          $           CONF.
 AJSEC   C/HLT,     0;C/TIJL,AJFSC          $           SECRET
 AJSNF   C/HLT,     0;C/TIJL,AJFNF          $           NO FOR
 AJCWI   C/HLT,     0;C/TIJL,AJFWI          $    LINE 10
 AJCWJ   C/HLT,     0;C/TIJL,AJFWJ          $    LINE 11
 AJCWLC  C/HLT,     0;C/TIJL,AJFWLC $
 AJCWNN  C/HLT,     0;C/TIJL,AJFWNN $
 AJPAGE  C/HLT,     0;C/TIJL,AJPGF          $
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AJCWMR C/HLT,    0;C/TIJL,AJFWMR $
AJCWL  C/HLT,    0;C/TIJL,AJFWL             $
AJINERCC/HLT,0;C/TIJL,AJINERF               $
AJFWH  C/HLT, 3*128+ 3;C/CAM,AJLN8          $          LINE 8
AJFCL  C/HLT,17*128+17;C/TMA,AJUN           $          LINE 9
AJFCL1 C/TCM,21*128+ 0;C/TMA,DFN            $
AJFCL2 C/HLT,29*128+ 7;C/TMA,TFN            $           OR
AJFCL3 C/HLT,30*128+ 1;C/CAM,AJCRLF         $
AJFCF  C/HLT,34*128+34;C/TMA,AJCON          $          LINE 9
AJFCF1 C/TCM,38*128+ 0;C/TMA,DFN            $
AJFCF2 C/HLT,46*128+ 7;C/TMA,TFN            $           OR
AJFCF3 C/HLT,47*128+ 1;C/CAM,AJCRLF         $
AJFSC  C/HLT,22*128+22;C/TMA,AJSC           $          LINE 9
AJFSC1 C/TCM,26*128+ 0;C/TMA,DFN            $
AJFSC2 C/HLT,34*128+ 7;C/TMA,TFN            $           OR
AJFSC3 C/HLT,35*128+ 1;C/CAM,AJCRLF         $
AJFNF  C/HLT,34*128+34;C/TMA,AJNF           $          LINE 9
AJFNF1 C/TCM,38*128+ 0;C/TMA,DFN            $
AJFNF2 C/HLT,46*128+ 7;C/TMA,TFN            $
AJFNF3 C/HLT,47*128+ 1;C/CAM,AJCRLF         $
AJFWI  C/HLT,24*128+24;C/TMA,AJLN10         $          LINE 10
AJFWI1 C/HLT,41*128+16;C/TMA,STNM           $
AJFWI2 C/HLT,42*128+ 1;C/CAM,AJCRLF         $
AJFWJ  C/HLT, 7*128+ 3;C/TMA,AJLN13         $         LINE 13
AJFWJ1 C/TCM,11*128+ 0;C/TMA,AJDDD          $
AJFWJ2 C/HLT,23*128+ 8;C/TMA,AJDATE         $
AJFWJ3 C/HLT,24*128+ 1;C/CAM,AJCRLF         $
AJFWNN C/HLT,17*128+17;C/CAM,AJNNNN         $          NNNN.12LTR S
AJPGF  C/HLT,60*128+ 4;C/TMA,AJPG           $
AJPGF1 C/TCM,64*128+ 0;C/CAM,AJPAGES        $
AJFWLC C/HLT,120*128+120;C/CAM,AJLTRCH      $
AJFWMR C/HLT,14*128+13;C/CAM,AJMRDTA        $
AJFWL  C/HLT,5*128+5;C/TMA,AJSAT1            $
AJFWL1 C/TCM,11*128+32;C/TMA,AJREV          $
AJFWL2 C/TCM,15*128+37;C/TMA,AJHR           $
AJFWL3 C/TCM,17*128+31;C/TMA,AJMIN          $
AJFWL4 C/HLT,18*128+ 1;C/TMA,AJDOT          $
AJFWL5 C/TCM,20*128+24;C/TMA,AJFRMIN        $
AJFWL6 C/ICOZ,27*128+1;C/TMA,AJELEV         $
AJFWL7 C/ICOZ,34*128+1;C/TMA,AJAZ           $
AJFWL8 C/TCM,41*128+18;C/TMA,AJRANGE        $
AJFWL9 C/ICOZ,48*128+1;C/TMA,AJRRATE        $
       HLT      54*128+2                     $
       TMA      FANNO                        $
       ICOZ     61*128+3                     $
       TMA      RSU                          $
       ICOZ     69*128+3                     $
       TMA      RSV                          $
       ICOZ     77*128+3                     $
       CAM      RSW                          $
AJINERFC/HLT,81*128+80;C/CAM,0,6X           $
AJNNNN A/NNNN;0/77777777$
       8/111111$
AJCRLF 0/32$
AJLN8  A/8T;0/32$
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AJLN10 A/ LOOK ANGLE SCHEDULE FOR$


AJLN12 A/ SAT    REV     TIME      ELEV  AZMTH  RANGE  R-RAT$




       SET      (P)+4                        $
AJLN13 A/DAY$
AJLN17 A/1AERO;0/32$
AJUN   A/UNCLAS SPACETRACK$


AJCON  A/C O N F I D E N T I A L SPACETRACK$



AJSC   A/S E C R E T SPACETRACK$


AJNF   A/S E C R E T N O F O R N SPACETRACK$



AJDOT  0/33$
AJPG   A/PAGE$
AJMRDTAA/    MORE $
       A/DATA;0/32$
AJUNITS  SET    (P)+6                        $
L AJACN  C/TMA,AJUNC;C/NOP,0                 $
       C/TMA,AJCONF;C/NOP,0                  $
       C/TMA,AJSEC;C/NOP,0                   $
       C/TMA,AJSNF;C/NOP,0                   $
       C/TMA,(P)+1;C/NOP$
       C/HLT;C/TIJL,(P)+1$
AJACN1 C/HLT,54*128+54;C/TMA,AJACN2$
       C/TCM,58*128+0;C/TMA,DFN$
       C/HLT,66*128+7;C/TMA,TFN$
       C/HLT,67*128+1;C/CAM,AJCRLF$
AJACN2 A/S E C R E T RELEASABLE OUTSIDE SSO CHANN$



       A/ELS SPACETRACK$

AJLTRCH48/1                                  $
       48/1                                  $
       48/1                                  $
       48/1                                  $
       48/1                                  $
```

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        48/1                                   $
        48/1                                   $
        48/1                                   $
        48/1                                   $
        48/1                                   $
        48/1                                   $
        48/1                                   $
        48/1                                   $
        48/1                                   $
        42/1;0/32                              $
AJUN1   A/UNCLAS NOCC-SD   $

AJCON1  A/C O N F I D E N T I A L NOCC-SD   $

AJSC1   A/S E C R E T NOCC-SD   $

AJNF1   A/S E C R E T N O F O R N NOCC-SD   $

AJACN3  A/S E C R E T RELEASABLE OUTSIDE SSO CHANN$

        A/ELS NOCC-SD   $
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```
*             SPECIALIZED SORT ROUTINE             $
              NAME      SORT                       $
      SORT    TJM       SORTX                      $
              CD                                   $
              TXDLC     ,3                         $
              TXDRC     ,5                         $
              TDM       RSSV35                     $
              TAD                                  $
              TDXLC     ,2                         $
              SLA       24                         $
              TMQ       1/1;15/0;32/1T47           $
              EIS       SORT3                      $
              SM        N/2T15                     $
              EIS       SORT4                      $
      SORT0   TXDLC     ,2                         $
              TDXLC     ,5                         $
              TMA       48/1T47                    $
              TMQ       22/1T22;1/1T47             $
      SORT1   ETD       0,5                        $
              JAGD      (P)+2H                     $
              JMP       SORT2                      $
              JAED      SORT2                      $
              TDA                                  $
              TXDLC     ,5                         $
              TDXLC     ,3                         $
      SORT2   TMD       SORT3                      $
              AIXJ      2,5                        $
              TMA       ,2                         $
              TMD       ,3                         $
              TDM       ,2                         $
              TAM       ,3                         $
              TMA       1,2                        $
              TMD       1,3                        $
              TDM       1,2                        $
              TAM       1,3                        $
              TMD       SORT4                      $
              AIXJ      2,2                        $
              TMD       RSSV35                     $
              TDXLC     ,3                         $
              TDXRC     ,5                         $
      SORTX   JMP       (P)                        $

      SORT3   C/HLT,0;C/HLT,SORT1                  $
      SORT4   C/HLT,0;C/HLT,SORT0                  $
      RSSV 35                                      $
              END       $
```

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